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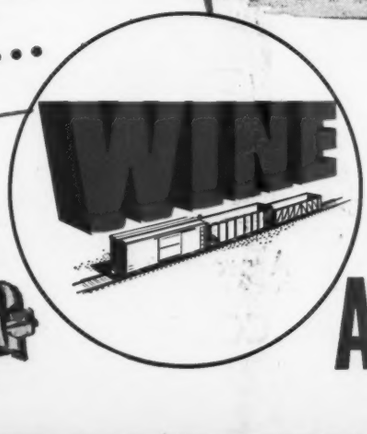

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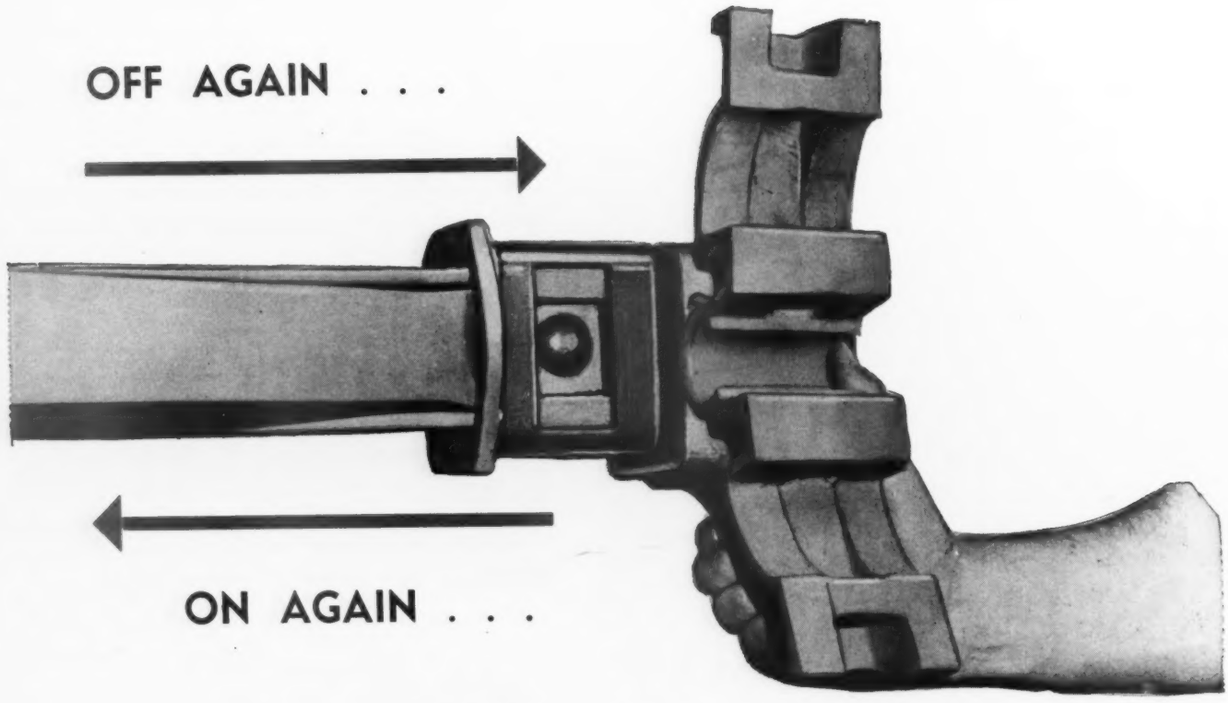

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No. 5

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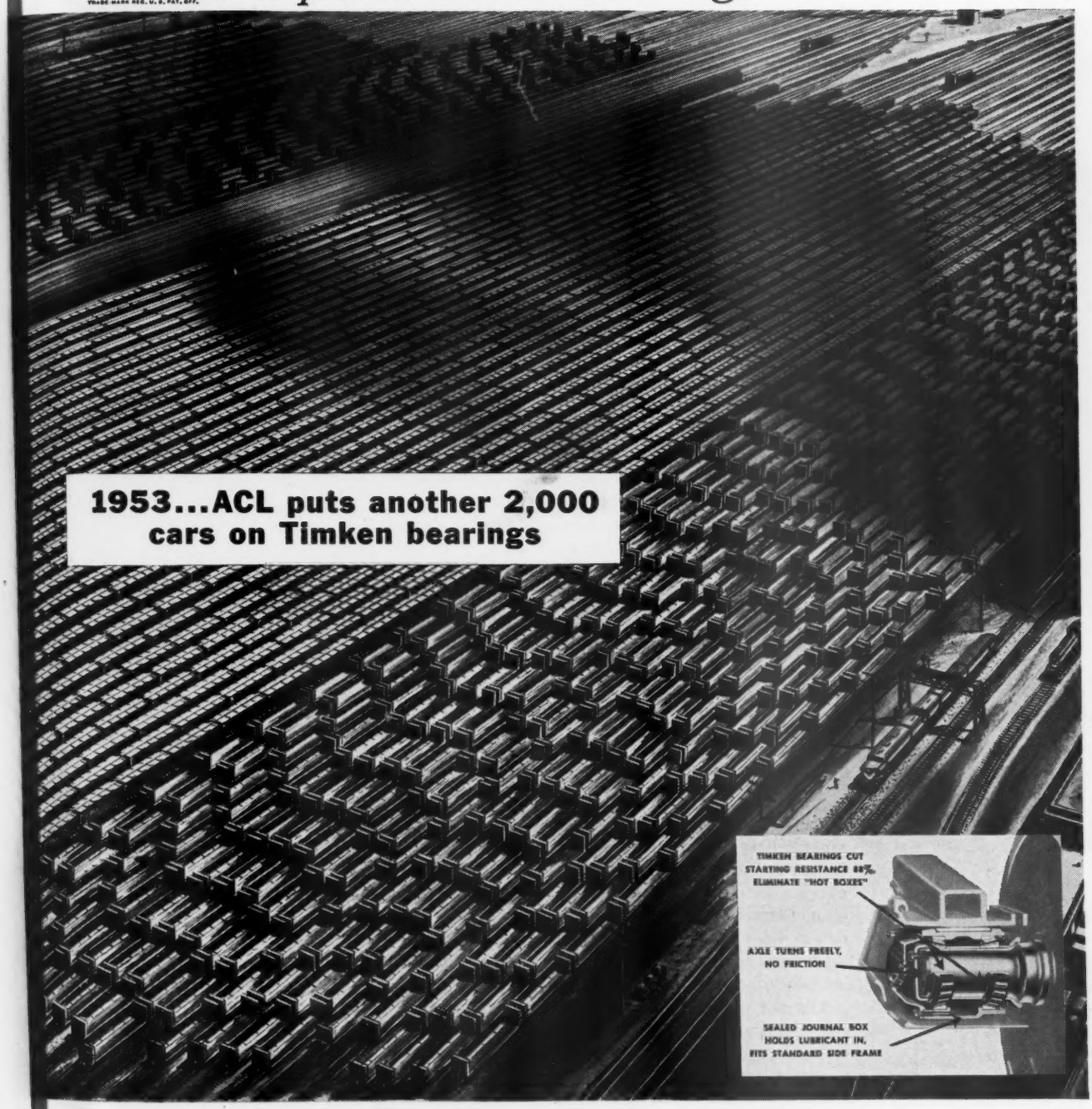
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Comment on this page in the April issue was addressed to the readers of this paper and dealt with the value to them of the information on the advertising pages. This month we are speaking to the advertisers.

You are entirely free to use your advertising space in any way you wish, so long as you stick to the truth and talk about your own product. But, with the interest of our readers in mind, the editor judges the excellence of advertising copy according to the value to the reader of the information it conveys. Judged in this way, the most valuable is the advertising which tells how the product functions, what its performance accomplishes, or how to care for and maintain it—information which answers some one or more of the questions the reader has in mind about it.

But why should you be interested in this? There are two reasons. If your product is new, obviously you want to talk about it. If your product is not new, you may already have told its story. But even though the product is not new, new supervisors are constantly being appointed as the older ones are dropping out. This turnover is going on constantly and its cumulative effect within a year may run as high as 25 per cent, taking all grades into consideration. So there is always a new group of men needing education.

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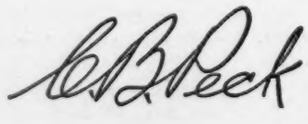
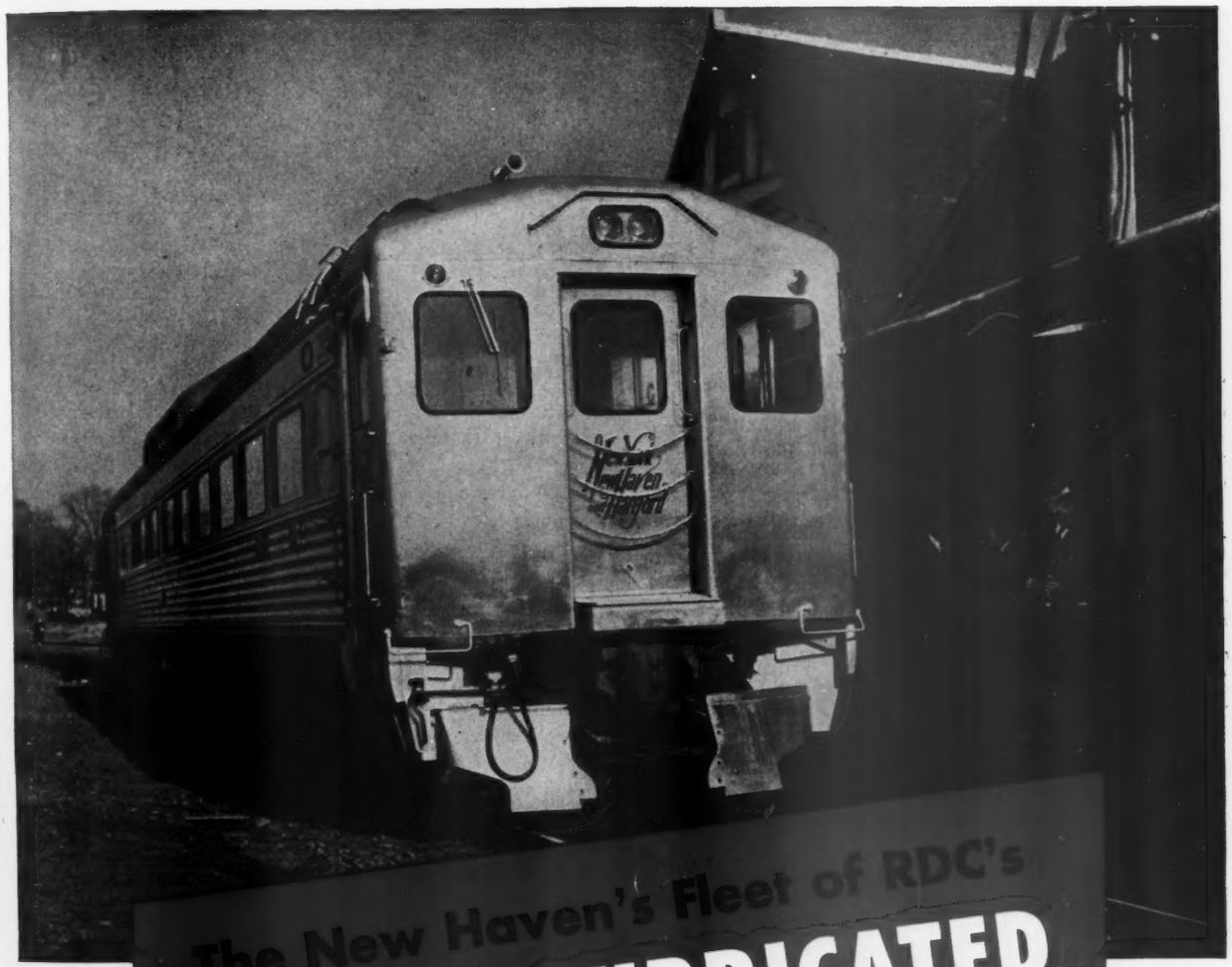
So, your real objective is best served if your advertising adds to the value of the magazine to its readers.





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EDITORIALS

Shop Load Factor

Traction motors and generators for diesel-electric locomotives must be overhauled and restored to first-class condition periodically. At longer intervals, this includes rewinding. Auxiliary electrical equipment up to and including the locomotive wiring itself must also be overhauled periodically or replaced.

Whether or not a railroad should overhaul or rewind its motors and generators depends on many factors, the most important of which is the number of locomotive units owned by the railroad. This, however, is not a fixed number for each road. By and large, a big railroad can afford to do rewinding, while a small one cannot. In course of time, the larger roads have been able to reduce their unit costs of both overhaul and rewinding.

At the same time, the builders' and other outside repair shops have increased their efficiency and the margin of saving in the railroad shop has become narrow. To warrant its existence, a railroad shop even though it is large, must be a good shop.

To operate effectively, a shop must have a good load factor; there must not be alternate periods of overload and idleness. Scheduling of motors in for overhaul can do much to even the flow of work through the shop, but even on the best-operated railroad, there will be peaks and valleys in the work to be done.

Theoretically, a railroad shop should have just enough capacity to handle the minimum amount of work going through the shop. The peak loads of work are then sent out to outside shops, and since these shops serve a number of roads, they can also have a reasonably good load factor.

In some cases, it becomes necessary for a railroad which has a shop to do all of the motor and generator work. One road in this situation has developed another means of using its facilities and manpower effectively. During periods of overload, some machines needing rewinding, are set off at one end of the shop. Then when a slack period comes along, they are put through the shop. This smoothes out the load but requires a very considerable investment in spare motors and generators.

On their attitude toward this situation, management, the railroad shop supervisory forces, the men in the shops and the operators of outside shops, all have a different attitude which has in it a certain amount of selfishness. The best procedure is the one most beneficial to the road. Lower costs and better operation mean more business and more work for the shops.

Refrigerator Cars in the Limelight

At a time when all classes of freight cars are being closely scrutinized, especially by railway men, for possibilities of increased utilization and earning capacity, the well-known "reefer," or railway ice box on wheels, is getting its full share of attention. Repair programs are being stepped up, some older cars rebuilt, new ones ordered and a considerable number of mechanically cooled cars either placed in service or planned for early delivery. Mechanical refrigerators, or RP-type cars, are much in the public eye at present and seem destined to prove their merit first in rail movement of frozen foods and commodities which must be handled at exceptionally low temperatures on more or less regularly assigned runs.

In discussing this subject at a recent meeting of the Pacific Railway Club in San Francisco, K. V. Plummer, vice-president and general manager of the Pacific Fruit Express Company said that refrigerator-car ownership in the United States has grown to a total of 128,147 cars which handle over 1⅓ million car loads a year, as compared with the first simple load of butter moving in a refrigerated railroad car from Ogdensburg, N. Y., to Boston, Mass., almost exactly 100 years ago. Most present refrigerator equipment is of the RS bunker-type, although report, railroads and railroad-owned private car lines placed 513 new R-type refrigerator cars in service in January, 1953, retired 213 cars and had 2,701 new cars on order at the end of the month.

Calling attention to the continued general use of water, ice and salt as the major means of cooling rail shipments, Mr. Plummer said that the efficiency, availability and economy of this method constitute a triumvirate hard to beat and that mechanical icers, now being installed to replace manual icing, will still further augment this advantage. He pointed out, however, that the three largest refrigerator carlines have already added to their fleets new cars equipped with mechanical units and predicted that other lines will follow this example in the near future.

Like other railroad equipment, refrigerator cars have undergone constant improvement, particularly in car bodies and trucks, insulation, floor-rack design, bulkheads, doors and other details. For example, the ever-wider use of steel has strengthened body structures to give there is a substantial ownership, of RA brine-tank refrigerator cars, used principally by the packing-house industry. According to the latest A.A.R. Car Service Division longer life and increased strength which in turn permits installing adjustable bulkheads for special loading. Floor construction has been thoroughly waterproofed and im-

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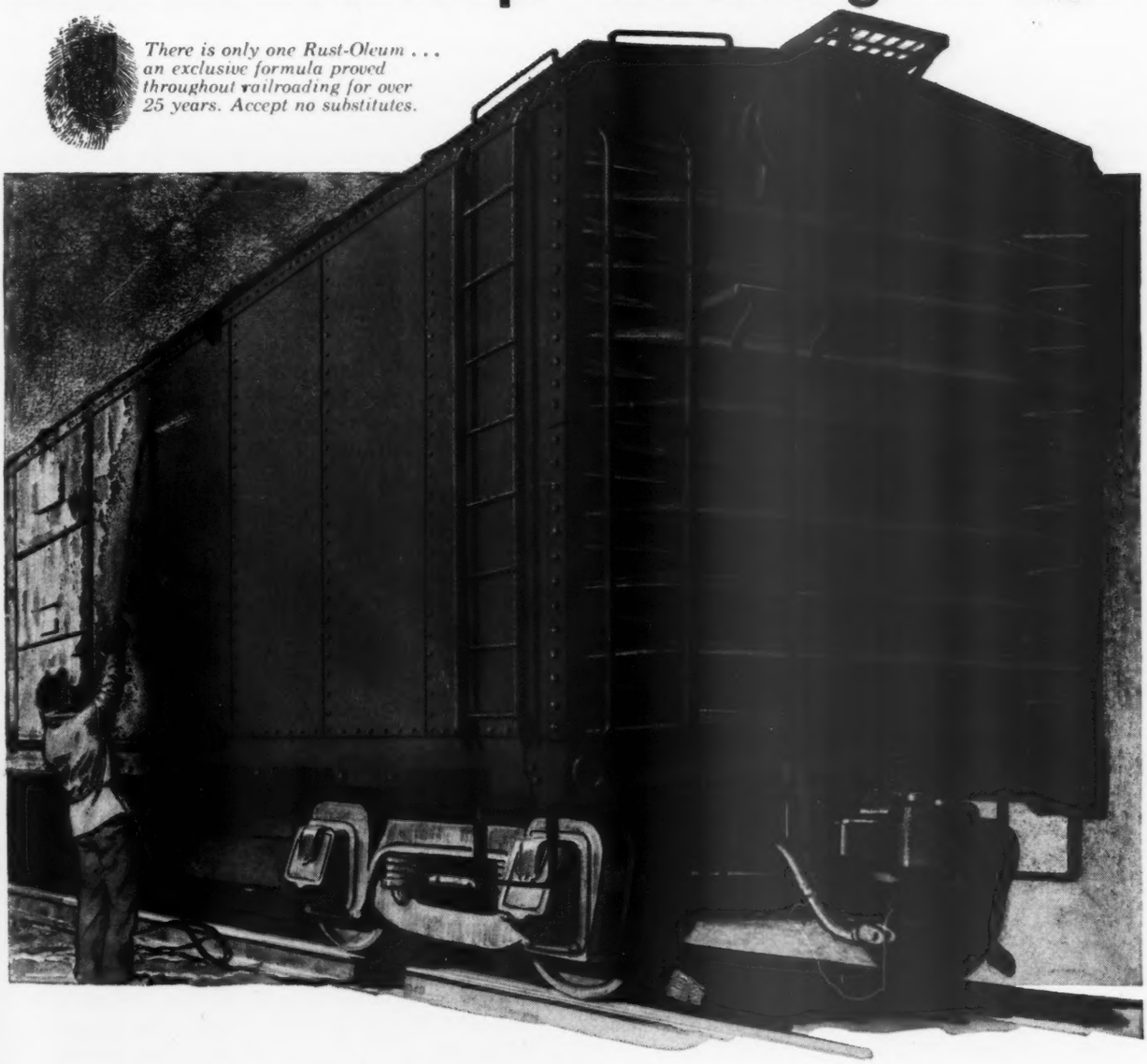

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proved, also hatch openings, plugs, covers and doors, all now more effectively sealed. This factor, in conjunction with better and thicker insulation in roof, floors and walls, supplemented by modern air-circulating fans, gives greatly increased refrigeration efficiency.

While most present refrigerator cars are slightly over 33 ft. long inside, about 1,600 cars with greater inside length have been built. These are called "jumbos," "giants," etc., to indicate their excess capacity. With heavier insulation up to seven inches thick, as compared with four or four and one-half inches generally installed, lower temperatures are possible and intensive refrigeration with ice and salt has permitted successful shipment of frozen foods in these large cars for distances of whatever length.

Nevertheless, as Mr. Plummer says, shippers want mechanical refrigeration because of the lower temperatures possible. Trucks are providing this kind of service and are taking business away from the railroads hauling commodities which require low-tempehature refrigeration.

Removability or Accessibility

Whether one is designing or maintaining a passenger car, a diesel locomotive, a gondola or a piece of shop equipment, there is one decision he invariably must make, whether he makes it consciously or unconsciously. Should emphasis be placed on making major sub-assemblies and appurtenances easily removable so that they can be quickly taken off for inspection and repairs? Or should they be so designed and located that they are accessible for maintenance in place?

One thing that must of course be taken into consideration in the case of cars or locomotives is a combination of the climate and whether servicing and maintenance is done indoors or outdoors. In cold climates a part on the outside of a car or locomotive is difficult to maintain where the work is done outside, while if inside, it is probably better to do the work with the part in place than to remove it. But when one gets beyond the more or less obvious cases, the problem calls for considerable judgment and analysis of the future.

There are many instances today where factors favoring removability balance those favoring accessibility. And it is here where thinking into the future becomes important.

It is virtually a universal tendency for any type of equipment to become more reliable as time goes on because of improvements in the product and because of greater familiarity with it on the part of those who maintain it. Would it not, therefore, in what is a borderline case today between the two characteristics, be more logical to favor accessibility rather than removability? Maintenance requirements decrease as reliability increases, but inspection is always important, and accessibility is an initial requirement for adequate inspection.

NEW BOOKS

SPECIFICATIONS FOR BRAZING FILLER METAL. *Issued jointly by The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. and The American Welding Society, 33 West 39th St., New York 18. 9 pages, 6 in. by 9 in. Price $0.40.*

Issuance of the Specifications for Brazing Filler Metal brings to eight the total in the series of filler metal specifications issued to date. These news specifications are especially important because they cover a field which has grown rapidly and has not heretofore been covered by specifications, except for a few specific materials. The Brazing Filler Metal Specifications cover every type of brazing filler metal in commone use today. The 33 different classifications are divided into groups according to the principal constituents. They include classifications for aluminum-silicon; copper-phosphorous; silver; copper-gold; copper and copper-zinc; magnesium; and heat-resisting filler metals. The Specifications, as usual, include an appendix giving helpful information for the selection of the brazing filler metal best suited for a given application. Among the factors included are the brazing temperature range for each classification, the color of the joint obtained, recommended joint designs and an explanation of some of the fundamental concepts of brazing which have previously been misunderstood.

AN ECONOMIC INVESTIGATION OF SOLID JOURNAL BEARING OPERATION IN FREIGHT SERVICE ON TWO LARGE CLASS I RAILWAYS. *By Prof. Roy M. Wright (deceased) and Donald E. Taylor, Mechanical Engineering Department, University of Illinois, and Prof. Robert Ferber and Francis S. Dotson, Bureau of Economic and Business Research. Published by University of Illinois Engineering Experiment Station, Urbana, Ill. Bulletin Series No. 406. 110 pages, 6 in. by 9 in. Paper bound. Price $1.*

Through the co-operation of two large representative railroads, which permitted the use of all available information pertaining to solid journal-bearing operations on their lines, the University was able to conduct this investigation to determine the economic effects of the use of solid journal bearings on railroad cars and to make corollary studies of factors influencing hot-box occurrences. Studies made both of the direct and indirect costs traceable to the use of solid journal bearings and the effects of these costs on railroad operation show bearing costs during 1951 of $7.59 and $8.53 per 1,000 freight car-miles on the two roads, or costs 42.5 and 57.2 per cent, respectively, greater than during 1948 when the investigation was undertaken. The cost investigation procedure presented in the bulletin can be used by any railroad to study its own expenditures.

Where, and How Often Do Hot Boxes Occur?*

Careful studies indicate the seasons and type of equipment causing most trouble, but principal cause remains the same.

BY M. A. PINNEY†

THERE can be no doubt that the railroads of the United States have a real problem on their hands in their efforts to reduce the excessive number of hot boxes. It is a problem which receives the attention of all railroad executives from the president down, and which certainly is foremost in the minds of motive department officers.

A recent report submitted by the Mechanical Division, Association of American Railroads, covering the operation of their Mechanical Inspection Department, showed that during the year 1951 a total of 201,076 cars were set out between terminals due to hot boxes or an average of 16,756 cars per month, while during the first eleven months of 1952 a total of 175,122 cars were similarly set out, an average of 15,920 cars per month. In addition there were undoubtedly a number of additional cars which experienced hot boxes and were nursed along to the next terminal without being set out; also a number found at terminal inspection and either repaired in the train or set out at the terminal. Hot boxes coming under these latter two categories are not included in the A.A.R. reports.

What is the situation with regard to hot boxes? Their frequency month to month? On what equipment do they occur most frequently? What is the effect of diesel operation? These, and many other questions present themselves and need to be answered in order intelligently to approach the problem.

Fig. 1 shows a comparison between train speed and hot boxes on the Pennsylvania railroad. You will note that starting with 1939 until 1943 there was a steady drop in train speed as represented by train miles per train hour. This has been followed by an increase in speeds, due largely, I believe, to the benefits derived from diesel operation. You will also note that, generally, when train miles per train hour is down miles per hot box are up and when train miles per train hour are up miles per hot box are down. I do not expect any relief in the future from a reduction in train miles per train hour —we are going to have to learn to operate at the higher speeds without hot boxes.

A check of our records showing miles per hot box dating back to 1936 shows that during 1936 our monthly average miles per hot box was 146,443 and this average showed a steady climb until it reached a peak of 267,839 during 1944. Since 1944 this monthly average has steadily declined until during 1952 it reached 122,746. Whether this decline since 1944 is affected by increased running

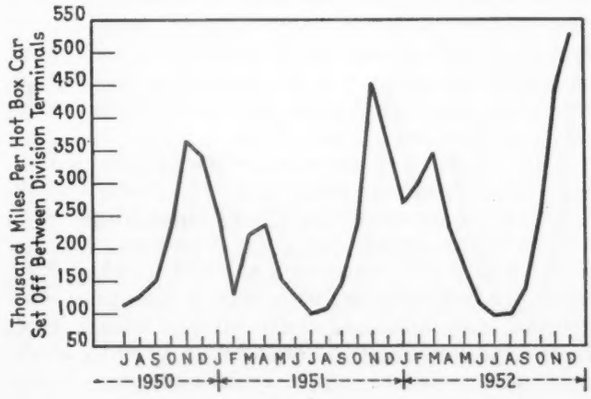


Fig. 1—How the miles per car set out because of a hot box varies with the seasons.

* Abstract of a paper presented before the March meeting of the Eastern Car Foreman's Association at New York. In his opening remarks the author made it clear that he would present his personal conclusions based on the results on investigations conducted in the test department of the Pennsylvania and did not speak as a representative of the railroad.

† Engineer of Tests, Pennsylvania.

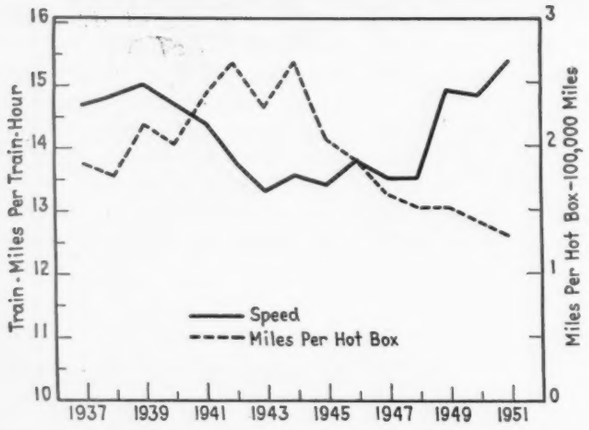


Fig. 2—The relation of freight-train speed and hot-box performance over a period of 15 years on the Class I railroads.

speed, decreased time available for servicing (both of which affect train miles per train hour), a combination of both or some other factor is not known at this time.

Fig. 2 shows freight car hot box data as accumulated by the A.A.R. in which the monthly national average miles per hot box for cars set off between division terminals has been plotted against the applicable month. This curve is interesting in that while it is based on the national average its general form is applicable to almost any railroad in the nation. The car miles per set off may (and do) vary for individual roads but the general shape of the curve remains essentially the same. You will notice a valley, or low milage per hot box, occurring during the summer months and a peak or high milage per hot box occurring in the fall and spring with an elevated valley between. This curve illustrates that generally the hot box problem is seasonal, occurring in one form during the summer months and in a different form in the winter months. The curve shows, however, that the summer troubles are the ones requiring the most attention.

For some time prior to 1950, we had suspected that our system 70-ton cars contributed more than their proportionate share of hot boxes. A survey of hot boxes on system cars to divide them between 70-ton cars and other-than-70-ton cars while somewhat time consuming was, of course, not difficult. However, to evaluate the percentage of hot boxes on 70-ton cars thus obtained was a more difficult task. In other words, if the survey of hot boxes on system cars showed 65 per cent of the hot boxes to be on 70-ton cars and the percentage of such cars operating over the railroad approximated 65 per cent of all system cars then, while hot boxes on 70-ton cars might constitute a major proportion of the total hot boxes, they nevertheless were not contributing in excess of their proportionate share.

A review of hot boxes on our railroad occurring during July 1950 showed that there were a total of 1,259 hot boxes on system cars of which 843, or 67 per cent, were on 70-ton capacity cars. For November 1950, the total hot boxes on system cars was 378, of which 238, or 63 per cent, were on 70-ton cars. A record was also obtained of the movement of cars through Altoona Yard for the 24-hour period of November 19, 1950, on which date we experienced our heaviest movement during November, 1950. A total of 6,386 cars were handled of which 1,948 were system cars. These 1,948 cars were checked by number against our equipment register to determine the class of car. Of the 1,948 system cars 799, or 41 per cent, were of 70-ton capacity.

From this study we concluded that our 70-ton system cars which constitute approximately 38 per cent of our freight car ownership and 41 per cent of our system cars moving over the road account for about 65 per cent of the hot boxes occurring on system cars. This further provided a clue that in order to make the desired improvement in hot box performance it would be necessary to concentrate efforts on our 70-ton cars.

In order to correct a trouble you must first know what the trouble is. In order to learn what troubles needed to be corrected on our 70-ton cars a form was prepared and distributed to our various car foremen with instructions to fill in the form and forward it to the engineer of tests for every system 70-ton car which experienced a hot box during the months of March and July, 1951. These reports were tabulated and studied and the following conclusions (in part) were reached:

1. Approximately 65 per cent of the hot boxes on 70-ton cars occurred on Class H-21 and H-25 hopper cars. These two classes of cars represent only 58 per cent of the total number of 70-ton cars in service during March and July, 1951. This provided a further clue as to where to concentrate efforts to reduce hot boxes.

2. Approximately 55 per cent of the hot boxes occurred during the first six months service since repack. From this it appeared that more frequent repacking would hurt rather than improve the situation.

3. 59 per cent of the hot boxes occurred on the inside pairs of wheels. A hopper car, loaded with coal as well as empty, was checked on unit scales to check the individual weight on each wheel. When loaded or empty the weight on each wheel was found to be nearly uniform. A study of the force couples involved during impact coupling of a car, however, gives a clue as to the cause of this phenomenon. The center of gravity of a car body is in a plane higher than the plane of the couplers. Therefore, under impact conditions the force couple formed by the inertia of the car body at the center of gravity and the stopping force applied at the coupler causes the car body to raise at the rear truck. At the same time the force couple formed by the inertia of the truck applied approximately at the axle centerline and the stopping force applied at the truck bolster center casting causes the trucks to raise at the front wheels.

On the front truck, which has been more heavily loaded by the car body force couple, this does not cause bearings to raise from journals but on the rear truck, which has already been unloaded by the car body force couple, considerable displacement of waste and bearings may take place, setting up a waste grab which can ultimately produce a hot box. As either pair of inside wheels can be the front wheels of the rear truck, depending on which end of the car is being coupled, I believe the above theory accounts for the phenomenon of more hot boxes on the inside wheels.

4. In a majority of the cases reported the cause of the hot box could not be determined as all evidence was destroyed. However, in 45 per cent of the cases reported in March and 36 per cent of the cases reported during July, sufficient evidence did remain to assign a cause. Considering cases where sufficient evidence remained to

assign, a cause as 100 per cent, during March 69 per cent and during July 61 per cent of the hot boxes resulted from waste grabs or low packing. Hot boxes from these two causes can be materially reduced by improved servicing of boxes at originating and intermediate terminals. A table shows in detail the causes of hot boxes as developed by this survey.

5. Approximately 72 per cent of the hot boxes occurred with pressed steel boxes while only about 64 per cent of our 6 by 11 boxes were pressed steel. A program is now under way to replace pressed steel boxes with cast steel or malleable iron boxes.

6. At the time of this survey approximately 57 per cent of our freight cars were equipped with spring packing retainers and it was assumed that roughly 57 per cent of the 70-ton cars were so equipped. The survey showed that 53 per cent of the hot boxes occurred on boxes equipped with retainers and from this I concluded that, at least during warmer weather packing retainers were not affecting a pronounced reduction in hot boxes.

7. Approximately 90 per cent of the hot boxes reported were on loaded cars, the balance being on empty cars. About 4 per cent occurred on cars definitely known to be overloaded. I do not know the full significance of this as I do not know what per cent of our system 70-ton cars operating on line during the survey were loaded nor do I know what percent were overloaded. However, for the year 1951, approximately 33 per cent of our freight car miles in freight trains was empty mileage. From that I conclude that loading is a factor in hot boxes and as 70-ton cars are usually loaded nearer capacity this may in part account for the 70-ton cars contributing more than their proportionate share of hot boxes.

As I view the hot box situation, there are two major subdivisions of the problems involved whenever efforts are made to improve the situation. These are (1) improvements which can be made in materials and methods prescribed for maintaining and packing boxes (including trucks) and (2) the degree of efficiency with which labor performs and utilizes the materials and methods prescribed. The work of a railroad test department is concerned principally with No. 1 but it does, on occasion, interest itself in the second of these major subdivisions.

One of the first studies we started was an attempt to evaluate the various car journal oils to A.A.R. Specification E-M-906-50, concerning their tendency to roll or displace packing in cold weather. These tests were made in our car journal test machine at Altoona and consisted of packing a box with our standard renovated waste saturated in the test oil. A hot run was then made to assure that the box operated normally, following which it was packed on the exterior with dry ice to reduce the temperature of the waste pack to 10 deg. F. to 20 deg. F. below the pour point of the test oil. When this temperature was reached, several starts were made in succession to determine whether the test oil would roll the waste pack. A number of tests were run until four oils were selected which ranged from the best to the worst oil insofar as its characteristic of rolling packing was concerned. These four oils were analyzed to determine if based on their physical characteristics any pattern presented itself that might account for and permit you to predict whether a given oil would roll packing. We could find no pattern and still have no answer to offer as to

CAUSES OF HOT BOXES ON 70-TON SYSTEM CARS

	March, 1951		July, 1951	
Total number of hot boxes	401		1,103	
Number of cars having hot boxes	386		1,057	
Cause of Hot box	*Number*	*Percent*	*Number*	*Percent*
Evidence destroyed	219	54.61	694	62.92
Waste grab	62	15.46	134	12.15
Low packing	62	15.46	114	10.34
Packing rolled or out of place	10	2.49	55	4.99
Broken or loose lining	21	5.24	40	3.63
Worn out bearings	10	2.49	20	1.81
Dry packing	....	....	10	0.91
Bearing out of place	4	1.00	6	0.54
Leaking box	1	0.25	5	0.45
Wedge out of place	4	1.00	3	0.27
Low oil	4	1.00	2	0.18
Canted truck bolster	....	....	2	0.18
Sand in box	....	....	2	0.18
Cut journal	....	....	2	0.18
Rough journal	....	....	1	0.09
Dirty packing	....	....	1	0.09
Wire between journal and bearing	....	....	1	0.09
Rusty pitted journal	1	0.25	1	0.09
Broken bearing	2	0.50	....	....
Water in box	1	0.25	....	....
Defective bearing	....	....	1	0.09
Unknown	....	....	9	0.82

why some oils apparently roll packing and others do not. Generally, it was established that the more highly refined oils rolled packing the least and apparently these highly refined oils having the lower pour points and lower viscosities at sub-zero temperatures had the least tendency to roll packing. This work was stopped when it was decided to operate the entire system on a 40-42 second viscosity at 210 deg. F. oil in order to evaluate the performance of such an oil.

I mentioned a 40 to 42 second viscosity at 210 deg. F. oil. During our tests on M-906 oil, we tested some oils which had a viscosity of 46 and 47 seconds at 210 deg. F. On our cold test, the 46 second oil showed itself to be a good performer insofar as rolling packing is concerned. Consequently, when we were approached to try the 40 to 42 second oil, we had some reason to believe it might be an improved car journal oil, at least insofar as cold weather operation was concerned. There was some question in our mind regarding its ability to give satisfactory performance in hot weather but the theory of additive additions to the oil to provide adequate film strength for hot weather operation appeared logical so it was agreed to give it a trial. It was believed, however, that the only way to arrive at any satisfactory conclusion was to operate the entire system on this oil and this was arranged. The operation of the system on this oil is still in progress and is in the nature of a test. All of these light oils currently approved for purchase were first qualified by a cold test and a hot test on a full size journal testing machine. No oils were approved which showed any tendency to roll packing under the cold test. The hot test consisted of operating the journal at a speed equivalent to 100 m.p.h. and suddenly reducing this speed to 10 m.p.h. in an ambient of 100 deg. F. and measuring the torque exerted on the journal box. Any tendency of the oil film to fail under these severe conditions would show up as an increase in the torque on the journal box. No oils were approved which showed any significant torque disturbance on the hot test.

Results to date indicate this light oil to be an improved oil for winter operation. During the winter of 1951-52, the light oil was in general use but not for sufficient time to say that all system cars packed on line were packed and free oiled with it. I think it is safe to say that during the winter of 1952-53, all cars packed on line and all

cars receiving free oil were lubricated with the light oil. The car miles per hot box set off, for January of the current and past two years show some measure of the performance of this light oil in cold weather. These car miles per hot box are:

January, 1951	154,965
January, 1952	246,410
January, 1953	303,663

We have operated with the light oil through only one summer season, to date, that is, the summer of 1952. The hot box performance last summer was poorer than the previous summer. However, due to decrease in business and the steel strike, our oiler organization during last summer was considerably upset by displacement of regular oilers and I have taken the position that under such conditions it was impossible properly to evaluate the performance of this oil. It is hoped that our management will allow the continued use of this light oil this coming summer at least until there is definite indication it is not a satisfactory lubricant, and that labor conditions will remain sufficiently stable that we can arrive at some definite conclusions.

We are today buying waste for journal box packing which is superior in quality to that required by A.A.R. specifications and paying a premium price for it. Waste manufacturers were required to submit samples of the highest grade waste they can consistently furnish and those meeting our high standards were approved for purchase. Our inspectors and waste plant personnel have samples of this approved quality waste and any lots of waste offered not meeting the standards of the approved samples are rejected. In a large measure, the maintenance of these standards for waste purchased rests with the test department.

We have tested a number of car journal lubricators on our bearing test machine. One lubricator, the Hennessy is applied to some freight cars for a road service test. Generally speaking, our tests of these lubricators has shown:

1. Most lubricators can satisfactorily lubricate the journals with a full supply of free oil in the box.

2. Most lubricators will produce bearing operating temperatures lower than produced by the standard waste pack with the same oil. Notable in this respect is the Empire lubricator which operated with a bearing temperature about 40 deg. F. lower than the waste packed box.

3. Most lubricators operate satisfactorily down to a minimum free oil level in the box but then fail to provide lubrication. The level of free oil required varies from lubricator to lubricator but in most cases the oil level required was greater than 1½ in. to 1-in. of free oil.

4. Based on what I have seen in testing these lubricators, I do not recommend the application of any lubricators without the concurrent application of oil tight seals at both the box lid and the dust guard. It is the failure to develop and furnish adequate seals which is holding back our road service tests of a number of these lubricators which have satisfactorily demonstrated their ability to lubricate during laboratory tests. We are currently engaged in testing several seals in the laboratory and it is hoped that some acceptable seals will present themselves during these tests.

5. To my knowledge, no lubricators have yet operated for sufficient mileage in normal road service to demonstrate their ability to stand up in service.

As to the standard bronze back journal bearing: During 1948, complaint was made that an excessive number of bearings were being found with loose linings and replaced in passenger cars. A survey was made and it was determined that 64 per cent of the bearings examined at random on cars in service had loose linings. A research program was initiated in which pilot lots of bearings were manufactured in our works using various fluxes, and tinning compounds to bond the lining to the back.

As a result of this research program we standardized on the use of zinc ammonium chloride as a flux and pure tin as the tinning metal. After these materials had been in use for about two years, we repeated in 1951 the survey that had been made in 1948 and found that the number of bearings examined at random on cars in service with loose linings were only 7 per cent. Since our bearings for freight cars are manufactured by the same process and methods as passenger car bearings, it is reasonable to assume that a corresponding reduction has been made in loose linings on bearings of our manufacture in freight cars.

Some work done by the Canadian Bronze Company indicated that increasing the zinc content of the bronze used in journal bearing backs would improve the bond strength between the lining and the back. To verify this work, we had three test mixes of bronze, each containing an increasing amount of zinc, made and bearings manufactured from these test mixes for comparison with bearings manufactured from bronze to A.A.R. specifications. Tests on bearings manufactured from these test bronzes showed increasing bond strength with increasing zinc content. Other bearing manufacturers also conducted similar tests with the result that A.A.R. Specification M-501 was changed so that effective January 1, 1953 the zinc content of the bronze backs has been increased from its old limit of 3 per cent max. (under which most bearings contained about ½ per cent zinc) to a range of 2½ per cent minimum to 4½ per cent maximum. An idea as to the extent of the benefits gained from this change can be realized from the following comparsion of bond strength tests made in our laboratory with the old standard bronze and the new higher zinc content bronze. Based on the bond strength of the old standard bronze at room temperature as 100 per cent the comparison is:

Old standard bronze at room temperature	100 per cent
High zinc bronze at room temperature	127 per cent
Old standard bronze after heating to 200 deg. F.	90 per cent
High zinc bronze after heating to 200 deg. F.	113 per cent
Old standard bronze after heating to 300 deg. F.	54 per cent
High zinc bronze after heating to 300 deg. F.	87 per cent

You will notice that at both room temperature and after heating to 200 deg. F., the bond strength of the high

zinc bearing is about 25 per cent higher than the old standard bronze bearing while after heating to 300 deg. F. The bond strength of the high zinc bearing is about 60 per cent higher than the old standard bronze bearing.

No discussion of hot boxes would be complete without saying something about packing retainers and containers. While the decision to use spring wire retainers in boxes of our system freight cars were made prior to tests made in our laboratory, nevertheless our laboratory tests indicated that wire retainers should provide some benefits in preventing waste displacements. You will recall, however, from my previous remarks that our survey into the cause of hot boxes on system 70-ton cars did not show that cars equipped with spring retainers were much, if any, better performers hot-box-wise than cars without retainers, at least insofar as other than winter operation is concerned. I believe this is due to two major causes:

1. Oilers will not remove the retainer in order to properly set up the packing when necessary to set up the packing with the result that they either pass up the box or do an inadequate job. Result—hot box. This is a job which supervision must police if the inherent benefits of the retainer are to be realized.

2. In separable boxes having a box bolt pocket running vertically up the box on either side of the journal, there is inadequate clearance for the retainer with the result that under impact conditions the retainer is pinched between the journal and the side of the box, nicking the journal or end collar. The A.A.R. interchange rules now contain a note prohibiting the use of retainers in such separable boxes. It is expected, however, that the A.A.R. Lubrication Committee will soon approve a new design of short retainer for use in this type box.

Checks made of boxes equipped with retainers as well as without retainers during winter weather, on the other hand, have definitely indicated the spring retainer is of benefit in reducing displacement of packing in cold weather.

The Plypak packing container was also subjected to extensive laboratory tests under which it demonstrated that it should produce considerable benefits in reducing hot boxes. Based on these laboratory tests, 3,000—70-ton hopper cars have been equipped with Plypaks. Experience to date has justified our confidence in the ability of this device to reduce hot boxes. From April, 1952 through January, 1953, the average percentage of our 70-ton hopper cars equipped with Plypaks has been 2.94 per cent, yet these cars equipped with Plypaks have accounted for only 77 per cent of the hot boxes on 70-ton hopper cars. In other words, in the same service, cars without Plypaks account for approximately four times as many hot boxes per car as do cars equipped with Plypaks.

While most of our work is similar to the type described above having to do with the materials and methods phase, we do, on occasion, conduct investigations into the performance of labor in using the materials and methods developed. One such test is, to me, extremely interesting. This test had to do with developing the cause of an excessive number of hot boxes being experienced on one of our freight train couplets. This investigation was made on relay Train VL2 operating from St. Louis to Enola and Train VL7 from Enola to St. Louis. While considerable information was gained regarding cars operating with box lids missing, packing displacing, percentage of cars with retainers, etc., the most significant development of the investigation is covered by the following excerpts from our report:

"This investigation was made by test department inspectors stationed at Enola, Altoona, Pitcairn, Columbus, Indianapolis, Terre Haute and East St. Louis."

For a two-week period prior to our investigation July 24 through August 6, 1950, a record was taken of the hot boxes experienced. During this two-week period, there were 10 hot boxes on Train VL2 and 9 hot boxes on Train VL7, total 19. On the first day of the investigation our inspectors only observed the practices being followed by the oilers. On this day, August 7, Train VL2 had two hot boxes and Train VL7 had one hot box, total three. Our inspectors then insisted that attention as required by our lubrication instructions be given each car operating in these two trains. During the thirteen day period, August 8 through August 20, Train VL2 had one hot box and Train VL7 had one hot box, total two.

"A check of the M.P. 36 reports covering the 19 hot boxes experienced during the two week period immediately preceding the test period showed a total detention of 393 minutes. During the first day of test period, the three hot boxes caused a total detention of 50 minutes while during the balance of the test period (13 days) the two hot boxes caused a total detention of 37 minutes."

In other words, during the fifteen days during which our inspectors exercised no supervision over the lubrication work being done on these two trains, there were a total of 22 detentions averaging 30 minutes per day while during the thirteen days during which supervision was exercised there were a total of two detentions averaging three minutes per day. Further, quoting from the report, it was concluded:

"1. The excessive number of hot boxes on these trains, and probably other freight trains is largely due to

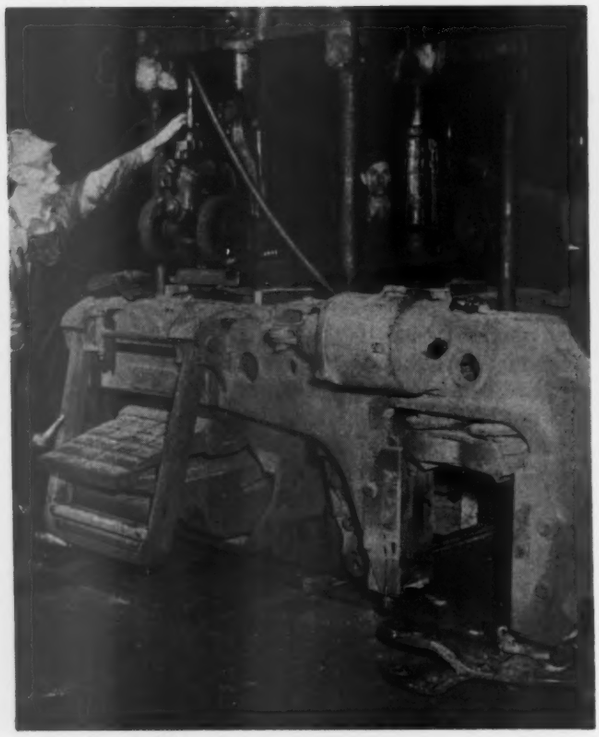
(a) Not servicing, or hurried and improper servicing of journal boxes.

(b) Lack of experienced men assigned to oil and reset packing and check waste grabs.

(c) Too much packing in a number of boxes (mostly in foreign cars) and packing rolled up to the bearing on the rising side and out beyond the collar in boxes without packing retainers.

"2. The materials currently being used while capable of being improved are such that they are not the major cause of hot boxes, and with proper servicing they are such that hot boxes can be materially reduced."

I have experienced nothing since the date of this investigation which leads me to believe we were wrong in our Conclusion No. 2 above. I am convinced that you, as car foremen, have it within your power to do more toward reducing the hot box problem than any other group of men employed on the railroads. Management is spending millions of dollars in programs to improve oil and waste, improve truck, maintenance, replace worn out pressed steel with cast steel boxes, apply modern trucks, apply packing retainers and containers and to test and investigate and research new materials and methods; but they will all be to little avail unless you as car foremen see that the efficiency of your labor utilizing these materials and methods is raised to a new high level.



Arrangement for compressing diesel truck springs for applying the spring hangers and the safety hangers.

Device Compresses Diesel Truck Springs

Diesel truck elliptic springs are compressed quickly and safely for applying safety hangers and spring hangers by a device which is also suitable for removing and applying springs without taking out the traction motor. A compressing device suspended from the traveling crane and operated by two 50-ton air jacks does the job. The principal parts of the compressor are two jacks, two top rails, four upright rods, two bottom rails, two jack seats and two jack head plates. The bottom rail goes under the spring plank, and the jack goes between the top of the spring set and the bottom of the top rail. As the jacks raise the top rails they also raise the bottom rails through the upright rods, thereby compressing the springs.

For safety, the jacking plate has three seats welded to it. Two are on top, and in them the jack bases fit. The third is on the bottom and fits in the truck center plate. Two bosses on the under side of the plate fit in the side bearing holes. The plates over the jack heads which contact the top rail have a ½-in. dowel that mates with a dowel hole in the bottom of the top rail and prevents the jacks slipping away from under the rail.

The following steps are involved in the complete procedure of compressing the springs and applying the safety hangers and the spring hangers: (1) Place the bottom rail directly underneath the spring plank on two wooden planks 4 in. by 8 in.; (2) Place the springs on the spring plank; (3) Put the center castings on the springs; (4) Apply the truck frame; (5) Put two filler blocks on the truck center plates and place one jack on top of each filler block; (6) Assemble the top rails and the upright rods to the bottom rails and over the partially assembled truck; (7) Put the spring hangers loosely on the pins; (8) Compress the springs by raising the jack shafts until the spring hangers swing freely under the spring planks into place; (9) Apply the safety hangers in the same way as the spring hangers were applied; (10) Knock out the spring pins which secure the upright rods to the bottom rails and lift the top rails and upright rods clear of the job.

With the springs compressed the hangers are easily put in place.

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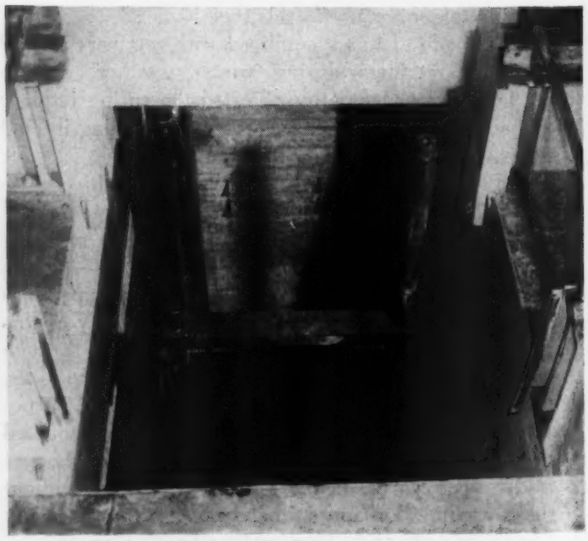
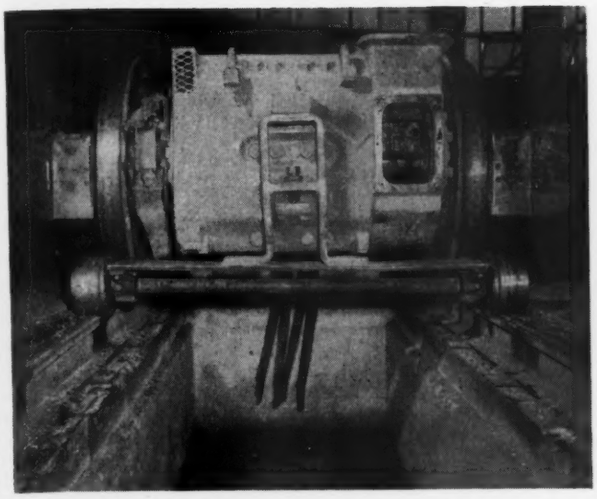


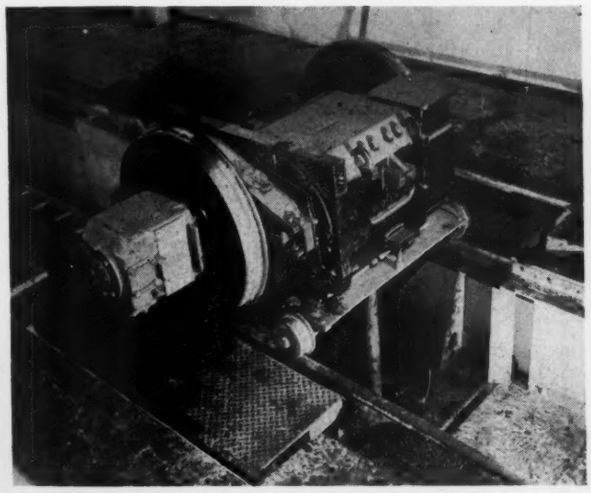
Adjustable ram, for compressing suspension springs and for supporting traction motors, in place on one of the two bosses.

Drop Pit with Traction-Motor Guide

Whiting drop pit at the Spencer, N. C., shops of the Southern has been modified to compress the traction motor suspension spring and to support the traction



The traction motor is supported firmly on both lugs by tightening the cap screw.



After the suspension spring is compressed and secured, the traction motor is lowered onto one of two types of dollies for support and further movement.

motor of a diesel locomotive driving wheel set. The modification consists essentially of an adjustable ram that rests on one of two bosses welded to a beam that has been added to the lower lifting mechanism.

The complete procedure involved in dropping a pair of driving wheels begins by spotting the pair to be dropped at the center line of the table. Two hinged wheel stops are raised to secure this pair of wheels, and the brake rigging is removed. The ram is raised independently of the table to compress the traction motor suspension spring set, which is secured in the compressed position by a slip washer and removed from the motor after lowering the ram. The ram is again raised against the bottom of the motor housing and the motor lifted to clear the safety lugs. With the weight off the latches, the lever can be thrown to drop the table, and the driving wheel assembly is lowered. A safety chain goes around the ram to prevent cocking from the angularity of the traction motor load.

The beam added to the lifting table has two bosses. The ram slips over one boss when dropping the No. 1 and No. 4 driving wheels, and over the second boss for dropping No. 2 or 3 wheels. The beam is so located that, with the ram in place on one of the bosses, the ram contacts the traction motor far enough behind the motor lugs to permit a two-wheel dolly to be slipped under the end of the motor and to support it for further movement of the wheel set. Two types of dollies are used, one for switch locomotive motors and a second for road locomotive motors.

The bosses have an outside diameter of 3½ in., and the ram has the same inside diameter for a snug fit. The top of the ram has a ¾ in. hole drilled through both walls. This is used to secure in place a step-size filler piece which slips in the top of the ram and is held by a bolt. Additional height adjustment is made in 1-in. steps by a second filler piece that has a boss on the bottom which fits in a hole in the top of the first piece. The tops of both pieces are knerled to eliminate slippage against the traction motor housing.

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Old nut facer adapted for polishing the inside diameter of locomotive pinions.

Polishing Pinion Inside Diameters

The addition of an adapter to an old nut facer has provided the Frisco shops at Springfield, Mo. with a handy machine for polishing the inside diameter of diesel locomotive pinions.

The adapter which is affixed to the former nut facer is simply a hollow cylinder open at the outer end, and the approximate length of the pinion. The pinion fits

loosely inside this adapter. It is secured in place by two 5/8-in. round bars.

The two bars are slightly flattened along one surface, the surface away from the pinion center. Set screws in the adapter turn down on the flat portion of this bar to hold the pinion in place and to revolve it.

The polishing itself is done by hand with emery cloth. To accommodate the different size pinions used on the railroad, three different size diameter adapters are used.

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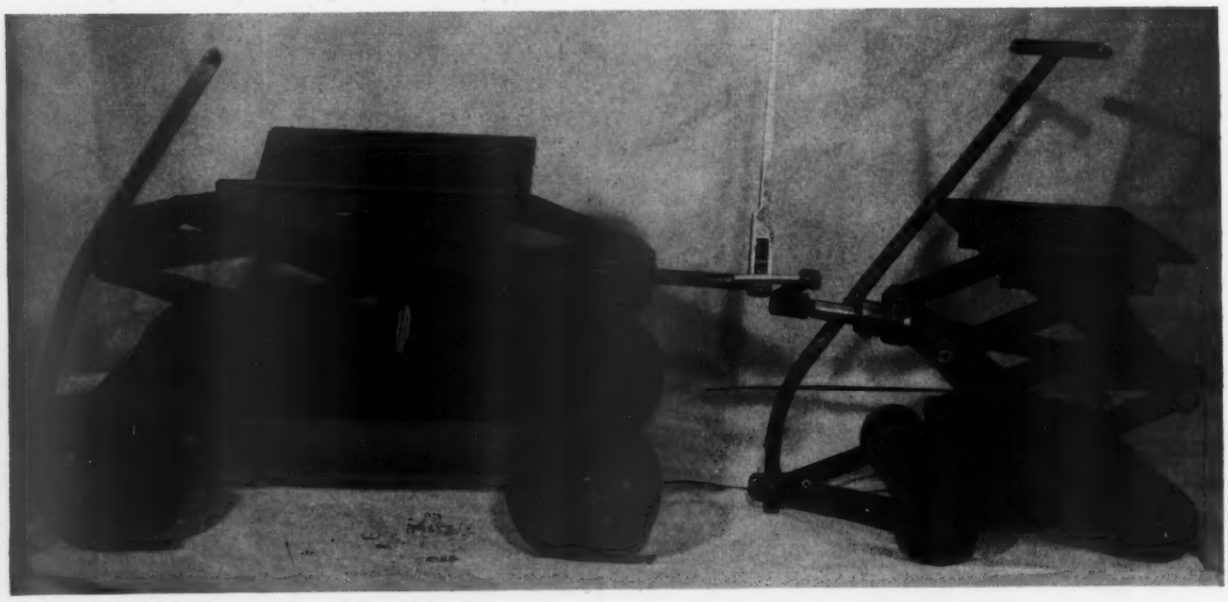

Two jacks for diesel locomotive work. On the left is a reservoir jack and on the right a draft gear jack.

Reservoir and Draft Gear Jacks

Two jacks have been built at the Southern's Spencer, N. C., shops for changing diesel locomotive reservoirs and draft gears. Both are scissors-type jacks and are constructed of ½ in. plate and strap iron ½ in. by 2 in.

The reservoir-changing jack can be used on any type of Diesel locomotive either in a pit or on the floor. It has a total rise of 48 in., and its lowest level is 11 in. above the floor. The screw shaft is 1½ in. diameter with 7 threads per inch. The end of the shaft has a 1½ in. socket for turning with a wrench. It requires about a half minute to raise the jack to its full height. Overall dimensions are 23 in. by 70 in., and the jack is self-locking in partially or fully raised position. The reservoir being removed or applied is supported on a concave plate ½ in. thick and shaped to the contour of the reservoir.

The jack for draft gears is similar but is lower and more sturdily built. It rests on four steel wheels 1½ in. by 5 in. and has overall dimensions 18 in. by 30 in. It is 11 in. above the floor at its lowest point and has a maximum rise to 30 in. above the floor. The platform is 14 in. by 14 in. It is operated either by a hand crank or by a ratchet.

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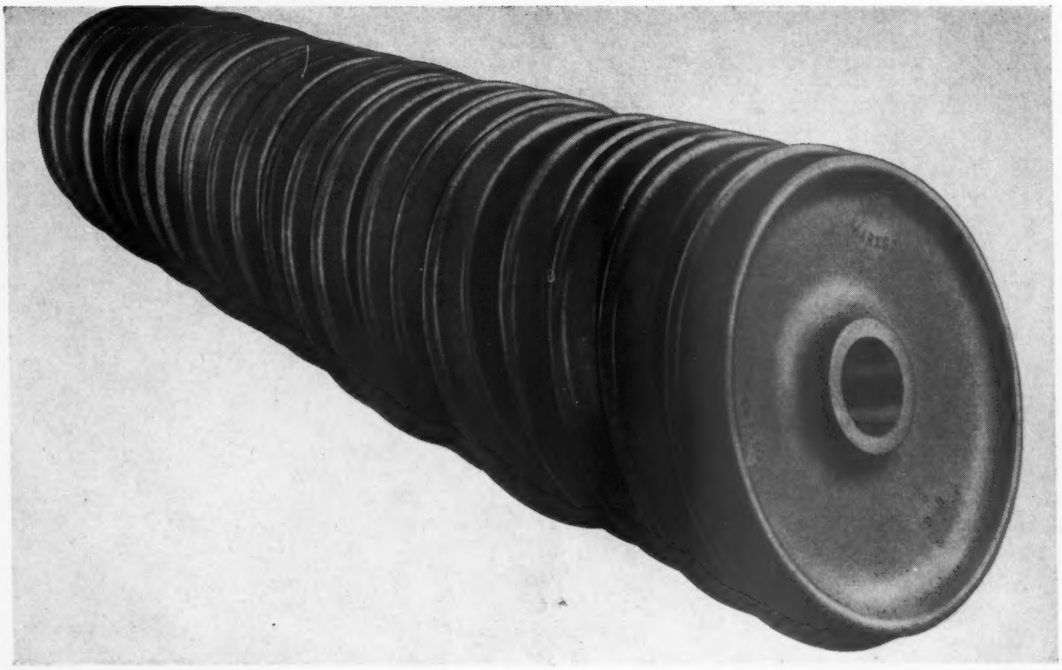
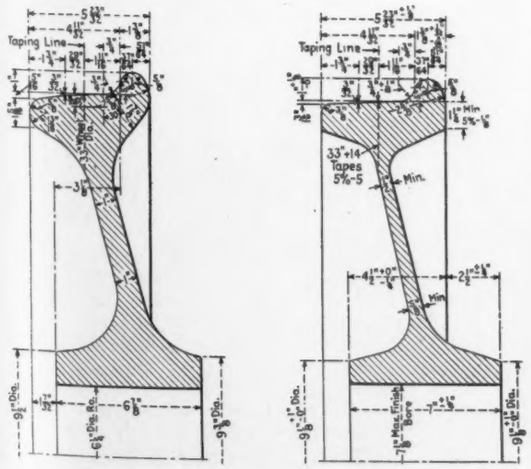
First diesel-electric locomotive equipped with four Caterpillar 180-hp. diesel engines and originally placed in service on the Peoria & Pekin Union in 1938. The locomotive weighs 105 tons and was built by Davenport-Besler. For the first few years, this locomotive worked on two shifts and in 13 years of railroad service averaged about 12 hours a day around the calendar. The locomotive was sold in 1952 and is now being used by the Newport Steel Company, Newport, Ky.



New type cast-steel wheels for railway freight service.

Graphite Molds Turn Out Steel Wheels of Uniform Structure

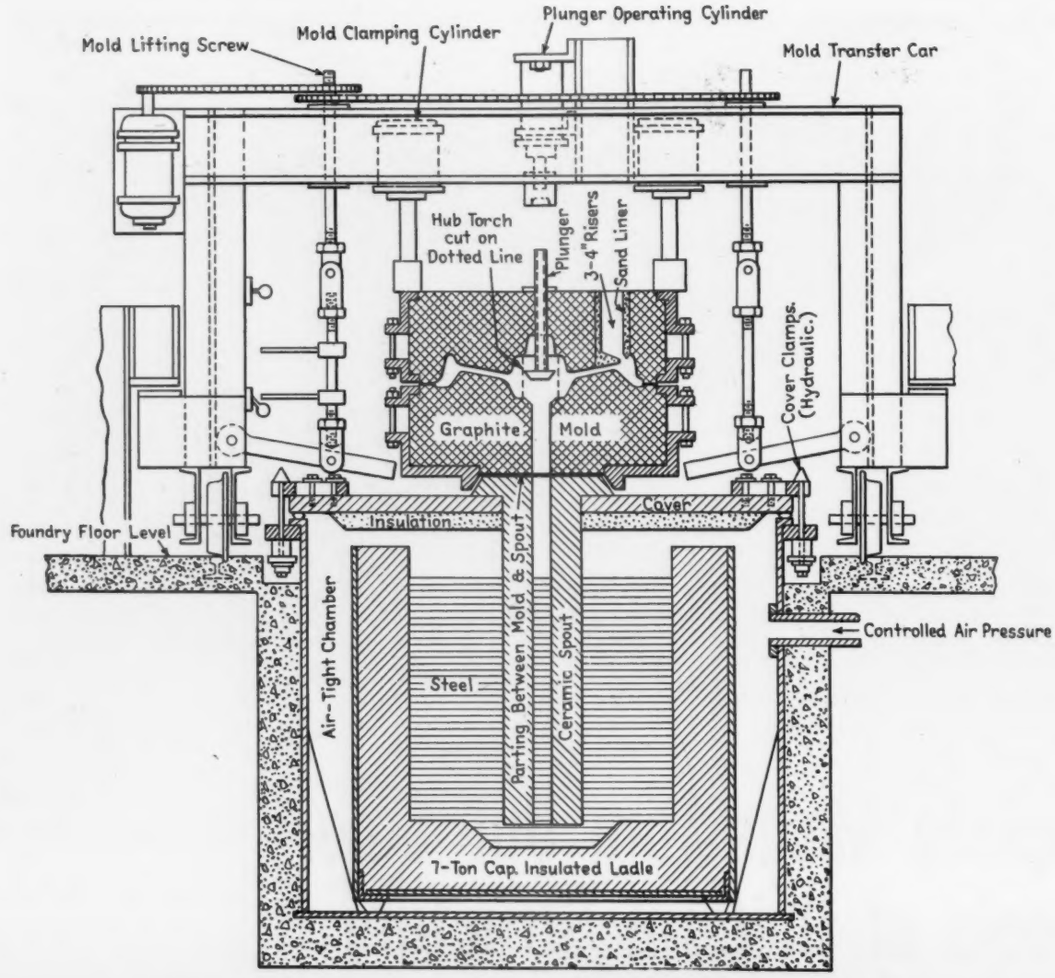
A.A.R. Wheel Committee recommends an increase in number of Griffin-made X-3 wheels authorized for interchange from 1,000 now in service to 100,000.



Cross-sections of the Griffin EQS wheel (left) and the A.A.R. standard one-wear steel wheel (right).

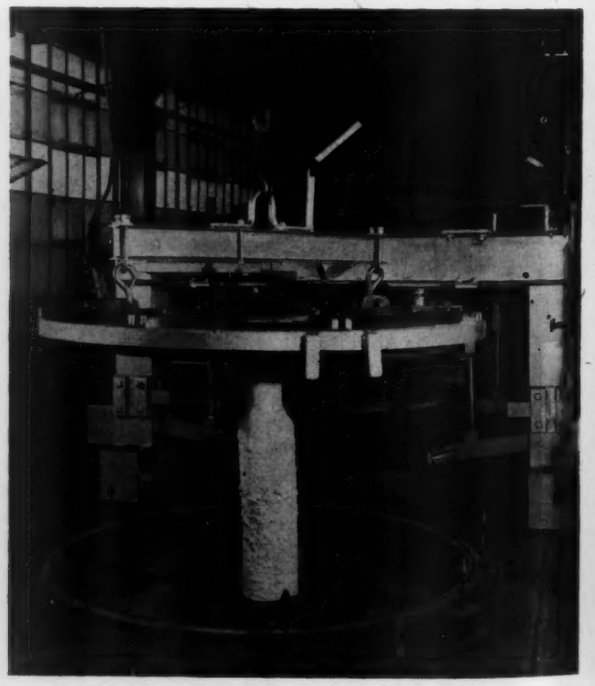
INTENSIVE research and development work over a period of ten years is represented in a new type of wheel for freight-car service now being produced by the Griffin Wheel Company. Made of .75 carbon steel, cast in the largest graphite mold ever made, this wheel has been designated Type X-3 by the Association of American Railroads and is called Griffin EQS (electric quality steel) by the manufacturer. One thousand of these wheels, originally approved for acceptance in interchange after January 1, 1952, are practically all now in service and the A.A.R. Wheel Committee recently recommended increasing the number to 100,000. The Griffin pilot plant at Chicago is being expanded and equipped to turn out 360 wheels a day at full production. A similar plant, but with about half that capacity, is under construction by the newly-organized Griffin Steel Foundries, Ltd., at St. Hyacinthe, Quebec, Can.

Advantages claimed for the new EQS wheel include better melting practice and control in relatively small

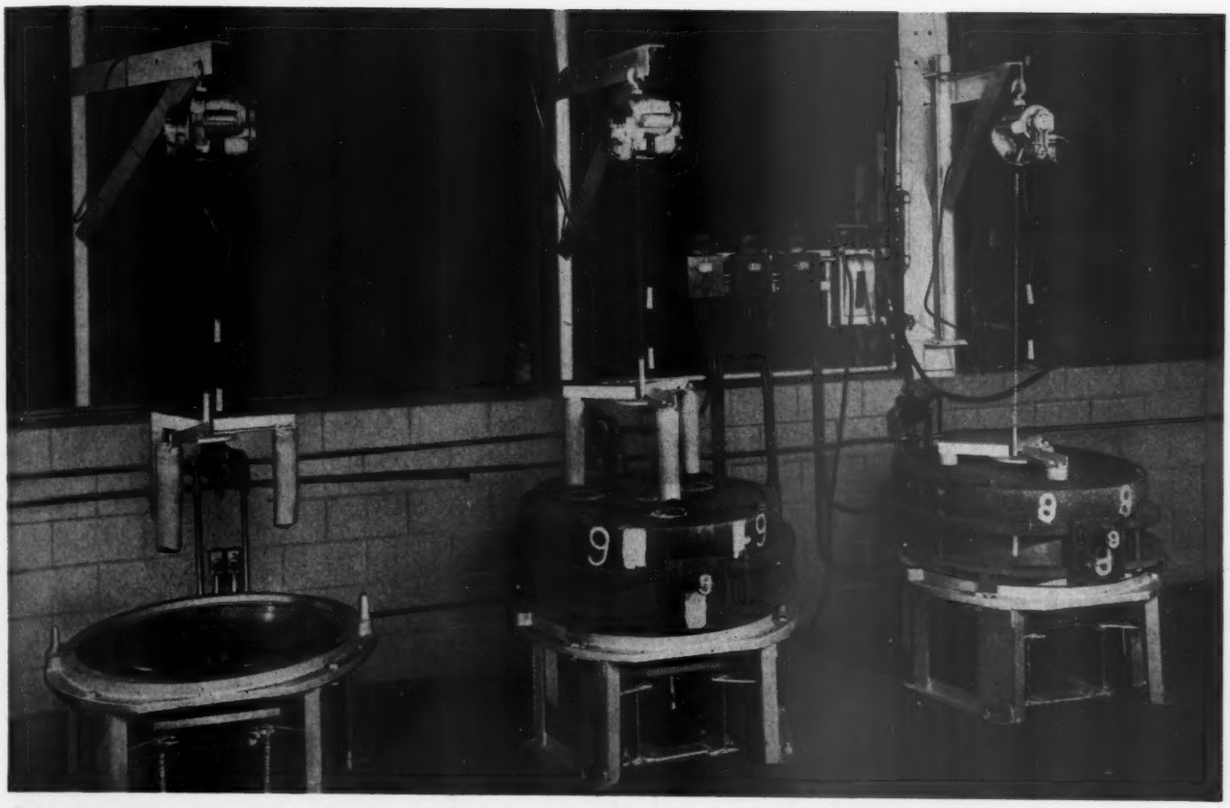


Schematic arrangement for pressure-pouring the Griffin EQS steel wheel in a graphite mold.

The Swindell basic electric furnace being charged, with the roof swung out of the way.



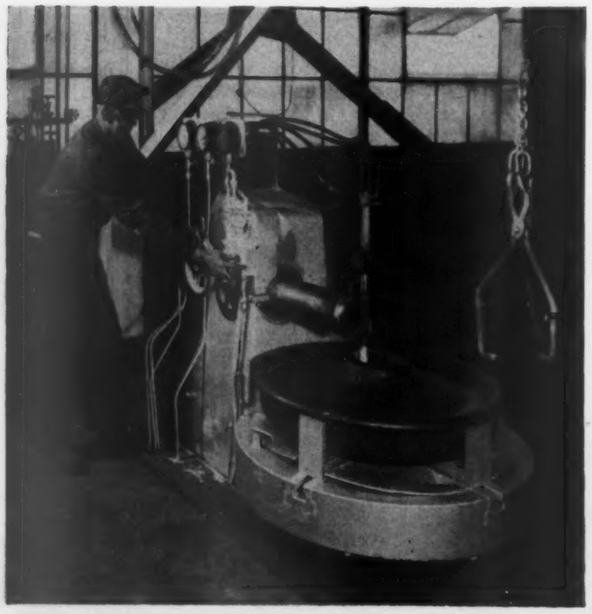
Ladle in the tank with cover and pouring tube ready to be lowered in place.



Core sand is poured around the sleeves inserted in the riser holes in the mold. The cores are baked by residual heat in the mold, supplemented from the electric resistance plate at the bottom.

Mold brought to pouring position and clamped in place by air cylinders on the gantry crane.

Molds moving on roller conveyors to gantry position (right) and returning (left).



Automatic hub-cutting operation in a finished EQS wheel.

electric-furnace heats, unrestricted wheel chemistry, improved design, as indicated by University of Illinois tests, more uniform product with close tolerances so wheels do not have to be machined to obtain equal tape sizes, and better appearance and balance.

The comparatively simple plant and unique method of operation result in economies which the manufacturer believes will permit making EQS wheels and selling them in competition with other types of steel wheels. Even though service tests to date are quite limited, sufficient physical tests are said to have been made to assure a wheel well adapted to meet the most severe modern operating requirements.

Another advantage claimed is ability to change readily the wheel design, weight, metal composition, or heat treatment, as necessitated by any special service conditions. Once established, all phases of melting and heat treating are automatically controlled as to time and temperature to assure maximum uniformity in physical properties of all wheels produced.

Largest Graphite Mold

The graphite wheel mold, made after considerable experiment by the Great Lakes Carbon Company, consists of two pieces of especially-prepared graphite 42 in. in diameter and 17 in. thick which are contained in an iron flask to prevent mechanical abuse. The wheel contour is cut in the graphite blocks on a King 60-in. vertical boring mill. It is possible with a special forming tool to machine the full mold contour with one tool and one machine setting. A mold may be re-machined in approximately one hour including setup time.

Steel for the graphite mold wheel is melted in a 9-ft. Swindell arc furnace powered with a 3,500 k.v.a. transformer. Any steel that will pour can be used in the Griffin process, but the .75 carbon steel wheel chemistry has a proven service record and it was decided to use this analysis on the first wheels. This steel is melted from selected steel scrap in a basic lining and poured from the

furnace at 3,150 deg. F. Complete deoxidation is done in the ladle using 2 lb. of aluminum and 2 lb. of calcium silicon manganese per ton of steel. One heat of steel will pour 18 to 20 wheels which have a finished weight of about 600 lb. each. One furnace operating on a three shift basis can pour 180 wheels in 20 hours. The steel used to date has the following analysis: Carbon .65 to .85; manganese, .60 to .85; silicon, .15 min.; phosphorous and sulphur, .05 max.

Steel Pressure Poured

The method employed to pressure pour into a graphite mold is shown in the schematic drawing. The ladle is placed in a steel tank and the cover, with spout attached, is clamped over the top of the tank. The mold is positioned and clamped over the tank and the metal is forced up into the mold cavity by introducing air pressure into the tank containing the ladle. After the mold is filled, a stopper is pushed through the mold to seal it. The tank is exhausted to atmosphere, permitting the metal in the mold beneath the stopper to run back into the ladle. A new mold is brought into position over the tank by a traveling gantry crane and the process is repeated.

The pouring rate into the mold is controlled by air pressure in the tank. The present practice is to build up the pressure in the tank at a rate of 1 lb. per sec., which raises the metal at the rate of 3 in. per sec. After the metal enters the mold cavity, the pouring rate is 150 lb. of steel per sec., a pouring time of 4 sec. per wheel.

To obtain a sound wheel, the mold is tilted slightly and three risers used to feed the tread section. This presented a problem which was solved by using one of the new dry-phenolic binders recently developed. This material permits setting cores in the graphite mold and using the residual heat of the mold to bake the core. The graphite mold process would not be practical without this method of setting cores.

The hub of the wheel is cast solid and cut out with an automatic torch in approximately 2½ min. with a gas consumption of about 20 cu. ft. of oxygen per wheel. The axle opening is always true and the inside wall of the hub surprisingly smooth.

After cutting the hub, the wheel is approximately 1,000 deg. F. or below the critical temperature. The wheel is heated in a gas-fired furnace to 1,550 deg. F. and held at this temperature for five hours. It is then removed from the furnace and differentially control-cooled in air to room temperature.

Design of the Wheel

Differences in design of the EQS wheel include large sweeping fillets under the rim and flange to permit the wheel to contract in the mold freely. The plate is thicker to permit faster pouring and for adequate strength. The broad fillets give better heat transfer from the tread to the plate when the wheel is subjected to brake shoe action and offer better support to the flange and rim. The uniformity of wheel size is indicated by a study of tolerance requirements. Necessary tolerances of EQS wheels are measured in thousandths of an inch and are said not to exceed .020 in. in any dimension except the diameter where a tape-size variation of not more than two, or .08 in. in diameter, is contemplated.

As a result largely of close physical tolerances, the EQS wheels are exceptionally well balanced. Representative tests in a modern dynamic balancing machine indicated six ounces minimum and 1¾ lb. maximum out of balance at rim diameter, as compared with 10 ounces minimum and 6 lb. maximum in other steel wheels.

The original 1,000 EQS wheels, now running under controlled service tests, are being checked periodically for visual defects and to obtain data on relative wear in comparison with other wheels on the same cars. Service performance to date is said to be even better than anticipated, with little evidence of wear on either tread or flange.

Brake, Plate and Rim Tests

EQS wheels have been subjected to ten drag tests at the University of Illinois laboratory, the surface speed of the car wheels being held constant at 45 m.p.h. The standard A.A.R. passenger-car shoes, all from one heat, were applied with a force of 3,000 lb. per shoe for 50 sec. out of each minute to a total duration of 30 min. for each drag test.

The wheels were stop tested from an initial surface speed of approximately 105 m.p.h. with clasp brakes using a force of 20,000 lb. on each of two shoes. The flywheel of the testing machine has a mass equivalent to a rail wheel load of approximately 24,000 lb. The energy dissipated for each stop from a speed of 105 m.p.h. was slightly greater than 9,000,000 ft. lb. Each wheel was subjected to 50 complete stops.

The tests imposed upon these wheels were considerably more severe than encountered in any normal freight service, being the equivalent of passenger-car wheel tests. The clasp shoes used in the tests increased the heat input to the wheel and in the case of the drag test, the cycling of the brakes permitted the shoes to last longer than if brake pressure were applied continually.

A series of EQS wheels has been subjected to static plate tests, both front hub and back hub in a 1.000,000-lb. test machine and demonstrated more than adequate static plate strength for any service. Some of these wheels were given severe static and dynamic rim tests in a special machine without breaking or showing any signs of distress. In static flange tests, individual wheels are said to have supported loads in excess of 500,000 lb.

EQS wheels have also been subjected to drop and thermal tests without failure, the former including 200 blows of the 250-lb. tup raised to its limit of travel and dropped 20 ft. Wheels, subjected to stress analysis before and after brake shoe testing, were said to show no residual or built-up internal stresses of a magnitude likely to cause failure. Wheels examined periodically by the Cobalt-60 radiographic inspection have proved to be sound at all points in the section and the uniformity of the graphite mold method apparently makes checking all wheels by this process unnecessary.

All Griffin EQS wheels which go into railroad service are completely shot blasted and magnetic particle tested using the Managlo method to assure sound wheels free of hot tears and cracks. The exceptionally smooth and clean appearance of the wheels is attributed to their manufacture in accurately machined graphite molds plus shot blasting which removes scale and brightens exterior surfaces. All features of the new Griffin EQS wheel development are covered by patent applications in the United States and Canada.

Shops and Procedures for

Heavy Freight-Car Repairs

Factors to be considered in planning a freight-car heavy-repair shop. Preparations for a heavy-repair program. A typical hopper-car rebuilding operation.

BY R. H. HERMAN

[Mr. Herman, who is engineer shops and equipment of the Southern, is the author of the section on Freight-Car Repairs which will appear in the forthcoming edition of the Car Builders' Cyclopedia. This article is taken from the part of the section dealing with heavy repairs. The Cyclopedia will be ready for distribution during the summer.—Editor.]

THE typical heavy freight-car repair shop on all but the largest railroads formerly consisted of a relatively small open-side shed with several related service buildings, the most important of which was the woodworking shop. This type of facility was fairly satisfactory when repair work consists primarily of renewing center sills, framing, siding and lining on all wood cars. It is totally inadequate and inefficient for heavy repair work on modern steel cars where the amount of wood in their construction has been reduced to a minimum.

As a consequence many railroads have constructed new or converted existing car repair shops and related facilities to permit performance of present day heavy repair operations in the most efficient manner.

Considerations in Planning Heavy Repair Shop

The principal factors which must be given careful consideration in planning a new or modified shop facility are as follows:

1. A heavy repair shop should be located near the geographical center of the railroad or area it is to serve and preferably near a classification yard to minimize back haul or extra movements of cars.

2. The availability of land, buildings, labor and material are important factors. If shop buildings are available or can be converted, the car repair operation will be less liable to interruption or delays due to the weather than if work is performed in the open.

3. Where practicable, even on a smaller railroad, the facilities should be arranged for repair operations on one class of car. This permits concentration of material and the installation of sub-assembly lines, platforms, racks and devices for efficient repair operations. Even if the entire shop cannot be assigned to a particular type of car, it may be possible to schedule the work or arrange the shop for repairs to one class at a time. During such periods miscellaneous heavy repair work can be performed at other shops or at a different and separate location.

4. The size of the shop naturally depends on the output that will be required from it. On the basis of a five year heavy repair cycle, 20 per cent of the cars must be put through the shop annually, whereas on an eight-year cycle the annual requirement would be 12½ per cent. The policy of a railroad with respect to retirement of obsolete cars and acquisition of new cars also has a definite bearing on annual requirements. Similarly, seasonal demand may determine requirements since it might be necessary to concentrate the heavy repair work on a certain class of car during a short light-traffic period.

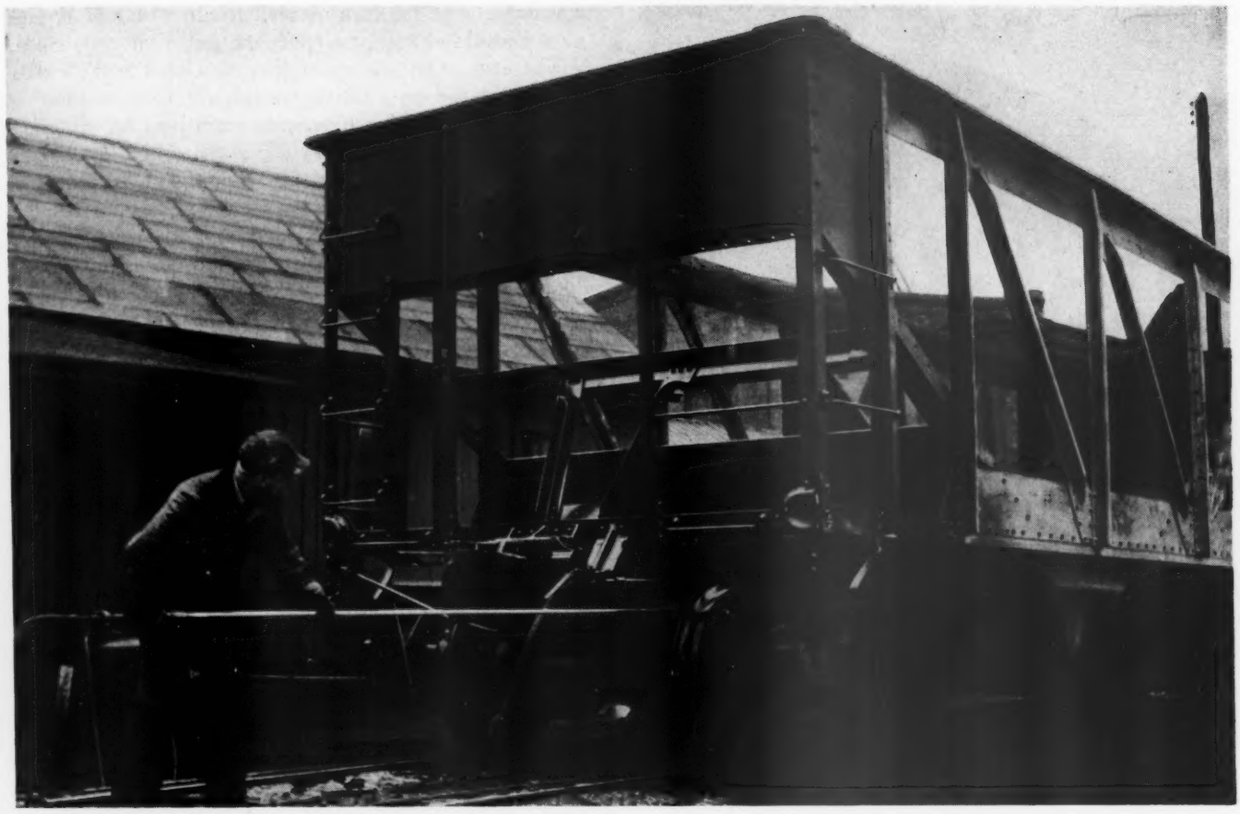
5. Consideration should be given to the possible use of heavy repair shops for the building of completely new cars. The trend on many railroads is to build sizeable quantities of new cars in their own car repair shops. Generally this work is restricted to gondola, flat, pulpwood, work train and the simpler type of cars. On this type of equipment, the railroad can purchase or fabricate in its own shops major parts such as underframes, sides, ends, roof sections, hoppers, doors and various sub-assemblies. These parts are assembled into a complete car in a series of relatively simple operations and with very limited shop facilities.

6. Much more elaborate facilities will be necessary if the railroad is to perform heavy program repair work or to build box cars, hoppers, and cement cars and to fabricate various parts from sheets, structural shapes, etc. Buildings of adequate size will then be necessary to house the fabricating work, sub-assembly jigs for sides, ends, underframes and space for the construction and assembly of the cars.

Unplanned Heavy Repairs Costly

Heavy repair work on varied and miscellaneous types of cars will consist of those operations requiring more than one, two or three days to complete. This will include repair or rebuilding of cars damaged in wrecks, derailments or accidents as well as the necessary work on bad order cars to upgrade or restore them to service for an additional period of years.

Where there is no fixed program for repairs cars are selected on the basis of a general inspection and a determination that a particular car cannot be continued in service any longer by ordinary light repairs. One indication may be extensive corrosion or deterioration of the underframe, sides and ends or the need for painting and in such cases the car inspector will "bad order" the car



Car and tracks are prime painted before the start of the assembly procedure.

and consign it to the nearest heavy repair shop.

In times of light traffic cars requiring heavy repairs may be stored near a heavy repair shop, to be removed and repaired in accordance with traffic demands.

This method of handling heavy car repair work has proven to be inefficient, costly and unsatisfactory for most railroads. It results in cars being retained in service until very heavy repairs or rebuilding are required whereas if periodic attention is given to the car, deterioration can be retarded and overall repair costs materially reduced.

Program of Progressive Repairs

During the past 10 to 15 years the railroads, faced with the heavy demands due to wartime and defense traffic, have acquired new freight cars in groups of hundreds or thousands of one type or class. Depending on the type of car and the service, these cars will require general repairs every 4 to 7 years. A repair program can be scheduled in advance to give each car of a particular series general repairs during a given period and at a selected shop. This procedure will eliminate painting between shoppings and reduce the number of bad order cars to a minimum as well as counteract the effects of progressive corrosion and deterioration. Program repairs can also be coordinated with retirements and eight or more years prior to such retirement, the work to be done can be reduced or limited to that absolutely necessary. This will insure that the car body as a whole will be worn out uniformly by the retirement date. After the cars have received their last general repairs they are kept in service by light repair work until unfit for further use.

Program repair work requires careful long-range planning and scheduling to insure maximum economies. An analysis should be made of the age, service, expected life, construction features, and failure reports for each series or class of car in operation.

Field inspections should then be made of representative cars in each series to determine general condition, extent of deterioration, amount of repairs required and particularly to secure an estimate of the date when that series is to be scheduled into the repair shop. On the basis of such an analysis and the inspection reports, tentative shopping schedules can be set up for each series of cars.

Estimating Materials Needed

At least one year in advance of the scheduled shopping date, a certain number of cars of that series should be forwarded to the heavy repair shop. These cars should be stripped down and rebuilt with an accurate record kept of all the material and parts required for this operation. A tabulation should be made of the repairs and items needed and an average secured representing the quantity required for one car of a series. This average figure can then be used in setting up a material estimate to cover the entire series. Necessary requisitions can be prepared and orders placed with suppliers or fabricators for delivery on a fixed schedule to coincide with repair operations. The purchase of large quantities of material or fabrication of parts in large volume should result in lower unit prices and costs as compared to purchases of limited and varied quantities for general repair work as needed.

The preliminary inspections and repair work may

Welding slope sheet in place in a hopper car.

indicate certain car parts which can be reclaimed or reworked successfully. Reclamation operations should also be scheduled so that sufficient items of this type are available to start the repair program and reclaimed items delivered to the repair location as required during the progress of the work on a given series of cars.

A careful check must be made regularly during the repair period of material orders and deliveries. It may be necessary to increase or reduce quantities of certain items if repairs required are greater or less than indicated by the average figure. Deliveries of some items may be delayed and special efforts can be made to expedite such shipments and prevent shut down or delays in the shop.

The Progressive System

The scheduling of repairs to one or more series of cars on a program basis provides an opportunity for very appreciable economies when such work is performed on a progressive or spot system. The progressive system is an adaptation of the assembly line idea used in automotive production plants to the railroad shop. To be successful and economical it must deal with relatively large numbers of similar units in about the same state of repairs and consequently this system is most desirable for program repairs or new car construction.

The savings and advantages result from greater production since employees can specialize at a particular operation; materials and tools can be located conveniently and jigs, fixtures and devices can be used for sub and final assembly. Supervisors can function more efficiently since they will be able to concentrate on weak spots after the operation has been started.

An important factor in the economical operation of a progressive system is to provide some means either by gravity, car puller or both for moving a car or group of cars from one position to another. The use of electric car pullers will be much more desirable than dependence on a switch engine for such moves. In any event employees must be warned and protected each time a move is made.

The general procedure in operation of a heavy repair facility on the progressive system will be somewhat as outlined below, subject to wide variations for different classes of cars.

The cars are spotted in the stripping area occupying one or more positions while the car is stripped down to the underframe or to the point where all corroded, defective or broken steel or wood parts are removed. This work is done by oxy-acetylene torch, using cranes to remove scrap. Lumber should be piled and burned.

The next general location provides means for cleaning the car and preparing it for the assembly line. Sand blasting, grit blasting, acid cleaning or hand cleaning methods are used for this purpose. The cars are then moved to the painting area where they receive one or more prime coats of paint or a protective coating before the start of the assembly work.

Car bodies are removed from the trucks at some point on the assembly line and are moved by dummy trucks or supported on pedestals until rebuilt trucks can be applied. Truck overhaul is usually performed on a separate track or at a suitable location where they can be returned to the assembly line without interference with work on the body or an excessive amount of handling.

The actual assembly locations may consist of a few or many positions depending on the output, force, extent of work, etc. The work done at each location must be carefully planned and supervised so that there will be no delays in movement of the car or time lost in waiting for the next car. The work starts with trimming, drilling and reaming of underframe for new reinforcements, parts or sub-assemblies, the installation of such parts, the installation of air-brake equipment, the work on sides, ends or roofs, the application of draft gear and couplers and, if a box car, the installation of floor and lining. Final operations cover installation of hand brakes, ladders and running boards, if required on that particular type of car.

The completed cars are then moved to the painting area which again may comprise two or more spot locations, for painting and stencilling. After weighing the car it is stencilled with the light load weight and is then ready for service.

A Hopper-Car Rebuilding Operation

A freight-car rebuilding operation on a midwestern railroad illustrates the benefits which can be effected by the use of a progressive assembly line for rebuilding a relatively small number of one class of car.

The particular program involved the dismantling and rebuilding of 1,385 hopper cars. This work was done in 7 stripping and 17 assembly positions on a single track about 800 ft. long. In spite of the fact that the assembly line, except for the final 327 ft. which was enclosed in a car-shop building, was out-of-doors, a full day's output could still be secured in case of rain. This was accomplished primarily by the layout of the production line plus an arrangement for shielding the key outside position with a canopy while rain was falling.

The production line was designed with a holding position between the end of the outdoor portion of the line and the beginning of the portion in the car shop building. There were seven stripping positions and nine assembly

positions ahead of the holding position, and seven positions, not including the painting locations following it. The holding positions provide an extra car or cars which can be put in the shop as required to replace cars delayed when the outside operations are slowed down.

The second insurance against delays due to bad weather was the use of a canopy which could be placed on top of the car bulb angles as needed by a large pneumatic tired A-frame. The A-frame was wide enough to span the car and was equipped with a traveling hoist to position the canopy on top of the car. This arrangement protected the key position of the outside section of the line.

The protected position was No. 4, the first of the two outside welding positions. The work at this location comprised welding of the center-ridge gusset top section and had to be completed before subsequent operations could be performed since this weld was covered by floor plates in a later operation.

The production line in general was laid out to build up the stripped car in three basic steps—apply some steel and rivet it; apply more steel and rivet it; and apply remaining steel and rivet it. Miscellaneous operations such as fabrication of parts and air brake and truck repairs, were performed at convenient locations.

Two post type cranes, shop built from scrap center sills and located at one side of the outside track, were used for handling floor sheets, cross ridge sheets and end patches. Each crane was equipped with a one-ton electric hoist and was operated by two men.

The car shop building which covered 327 ft. of the assembly line is of brick construction with concrete flooring and scaffolding on both sides of the track used for hopper-car work. Two 15-ton traveling cranes span the width and travel the entire length of the building. These cranes hang side sheets, pick up the end of the car for truck changes and pull cars from one position to another. Jib cranes with 20 ft. radii equipped with one-ton air hoists were also used in truck overhaul work.

Stripping

Stripping work was performed at five positions on one track and one on another. The car was stripped down to the underframe with the exception of the ends, bulb angles, corner sheets, corner posts and end posts. This work was done on moves of two cars at a time by 11 burners, 3 carmen, and 2 laborers and was divided between the six positions as follows:

At positions 1 and 2 (two burners, one carman and one laborer each) eight cars were stripped per day. Side sheets were dropped and side sill angles cut. The top and bottom floor sheets, the outside and inside hopper sheets, the crossridge sheets, the crossridge gussets and longitudinal hood sheets were removed. The steel ends were trimmed. Carmen and laborers removed scrap and piled it for later removal by bulldozer and carmen removed all rivets from center sills, floor pans and floor braces.

Positions 3 and 4 (two burners). Two cars were worked at a time, burning tops of side sheets loose, the stub posts off and the top halves of side and center splice plates. Output, eight cars per day.

Position 5 (two burners). Doors were burned down and door closing bars off the doors. Bottom door hinge angles and the cardboard brackets were burned off, and most rivets from the side sheets. Side posts were cut off from outside, and short splice plates burned off. Assisted on positions 3 and 4.

Position 6 (two burners and one carman). Three men at this two-car position on the second stripping track stripped the two cars complete and handled all scrap and reclaimed material. These two cars with the eight stripped on the first five positions furnished ten stripped cars for the assembly line.

Rebuilding

The cars were rebuilt in the following 17 positions:

Position 1 (one carman). The car was cleaned and prepared for the line by knocking off rust, blowing off and painting center sills.

Position 2 (one burner, one carman and one apprentice). Old center gusset sheets were trimmed off, side sills applied and fitted up and bent corner posts, end sills and top end sheets removed when necessary.

Position 3 (one carman and one apprentice). Longitudinal hood sheets, inside hopper sheets and floor plate supports were applied and fitted up. An additional carman assisted on heavy material and also worked on positions 2 and 4 as needed.

Position 4 (one welder, four carmen and two apprentices). Bottom floor plates, floor stiffener angles, door closing angles and outside hopper sheets were applied and fitted up. All holes were reamed. New center ridge gusset and side sills were welded in, and the cardboard brackets tack welded. The hand brake was applied and longitudinal hood sheets reamed. The large A-frame was used in this position to hang the gussets and the hand brakes.

Position 5 (two riveting crews of two carmen and one helper each). Bottom floor plates, longitudinal hood sheets, train-line brackets, floor angles, transom ends and hand brakes were riveted.

Position 6 (one burner, three carmen and one apprentice). The top floor plates, center ridge sheets, side corner-sheet patches and end sheet patches were applied and fitted up. Two jib cranes hung steel in this position.

Position 7 (one burner and two carmen). Top floor sheets, cross hood sheets, gussets and door hinges were fitted up and reamed.

Position 8 (two riveting crews of three men each). Top floor plates, center ridge sheets and bottom of the gusset were riveted.

Position 9 (two welders). The longitudinal hood sheets and ends, the outside of top floor plates and side bearings were welded in. Floor plates and cylinder brackets were tack welded. Four cars were held in this position for protection in case of rain.

Seven Spots Inside

Position 10 (six carmen and one burner). This was the first position inside the steel car shop. Here steel sides, posts and stub posts were hung and fitted up and safety appliances installed.

Position 11 (five carmen, three apprentices and two air men). Rivet holes in steel sides and ends of the car were reamed. The air men cleaned air brakes when needed, and did general air repairs such as changing hoses and angle cocks and testing the car.

Position 12 (three rivet crews and one burner). One rivet crew riveted the ends of cars in Positions 11 and 12. The other two crews riveted the gusset to the side sheet,

New side sheets are tack welded on a hopper car.

the floor to the side sheet and the short splice plates at the bolster of the car and the hinge butt angles.

Position 13 (four rivet crews). Each crew applied one-fourth of the car's side sheet rivets.

Position 14 (four welders, two burners, one carman, one apprentice and one painter helper). The welders applied coupler carrier irons, side corner patches and retainers in the truck sides and welded the inside of hoppers on the floors. The burners, carman and apprentice hung and fitted up doors, and straightened any bent ends, posts or grab irons. The painter helper removed rust and slag from the car.

Position 15 (nine carmen, two burners and two helpers). These men overhauled trucks, couplers and draft gear, and riveted tie straps, center plates, truck side bearings, and replaced any poorly driven rivets. The bodies of the cars in Positions 15 and 16 were supported on horses while trucks were being overhauled.

Position 16 (three welders). Laid up steel and welded holes around side posts, floor sheets and corners.

Painting Outside

Position 17 (two painters). This position was outside the shop building. The first coat of paint was applied after washing with solvent.

After application of the first coat, the car was switched to the paint track for second coat and stenciling which was done by five painters and four helpers. Two helpers also oiled and packed journal boxes when the paint work was completed.

One inspector and one air man worked the shipping track where they made the final air test, adjusted brakes and gave the car an overall inspection.

In addition to the men employed in the above operations, 18 men were employed on miscellaneous and sub-assembly work. One man was general inspector and a helper supplied oil for forges inside and outside the shop. One burner and two apprentices tore down, repaired, assembled and tested hand brakes. A crane operator handled wheels, trucks and steel sides, and moved the shop line.

Two jig crews riveted hopper doors, straightened angles on a press, operated riveting jigs for hopper pocket sheets, center ridge gussets, door angle hinges, door locks, hood-sheet brackets and floor-plate supports. Helpers carried sub-assemblies to various positions.

The above repair force with relatively simple facilities were able to increase the output from a scheduled seven cars per day at the start to an output of ten cars per day after six months of operation.

What's New in Interchange Rules

Latest changes the subject of discussion at a meeting of the Eastern Car Foreman's Association. Changes were reviewed by G. A. Mundt, supervisor, Billing Bureau, New York Central System.

DUE TO the continual improvements and changes in car parts, car construction, car servicing, interchange regulations, methods of repairs, billing practices, etc., it is necessary to make appropriate changes in the rules from time to time. Suggestions and recommendations for changes in the rules are made by various Standing Committees of the A.A.R., by railroads, private car lines and associations such as this, which are referred to the Arbitration Committee for consideration and action. Prices for labor and material are reviewed semi-annually by the Price Committee of the A.A.R. and revisions in such prices, recommended by that committee, are subject to approval by the Arbitration Committee.

Following is a review of the changes in the freight and passenger car rules effective January 1, 1953:

Rule 2

Paragraph (c)—Second paragraph modified by addition of new last sentence to indicate that the maximum quantity of regulatory commodities loaded into tanks is governed by limitation provided by Interstate Commerce Commission regulations.

Rule 3

Paragraph (a-4)—Modified to provide that on and after July 1, 1953, the movement of all freight cars in interchange service, other than tank cars, not equipped with air brakes meeting the requirements of the A.A.R. Specifications for Air Brakes adopted in 1933 is prohibited in interchange except that such cars on other than owner's line may be so moved prior to October 1, 1953, if routed to owner. On and after October 1, 1953, movement of tank cars in interchange service not so equipped is prohibited, except that such cars on other than owner's line may be so moved prior to January 1, 1954, if routed to owner.

"Note 2.—The date requirements ofr AB brakes as to I.C.C. Order as amended November 18, 1952, and to more clearly define meaning of the term "interchange service" as follows:

"Note 2.—The date requirements for AB brakes as contained in this rule are in accordance with I.C.C. Orders under Docket No. 13528. Under the order as amended November 18, 1952, the term 'interchange service' means the movement of any car that is engaged in freight service, irrespective of ownership, that is interchanged between or among two or more respondent railroads."

Effective date in following paragraphs extended to January 1, 1954, as shown in Supplement No. 1 to the 1952 Code:

Paragraph (b-7)—Brake levers—Application of metal badge plates.

Paragraph (b-9)—Braking power.

Paragraph (c-11)—Couplers with 5 x 7 inch shanks. This paragraph also modified to indicate that the requirement contained therein applies to all cars in interchange instead of from owners.

Paragraph (c-12)—Couplers with assembled lock lift lever and toggle.

Paragraph (c-13)—Vertical space between coupler shank and striker.

Paragraph (t-3-b)—Truck sides, "T" and "L" section.

Paragraph (b-8)—Modified and new Note 2 added to insure the application of brake beams of sufficient length to properly fit truck sides equipped with brake beam safety ledges. Such brake beams should have overall length not less than 66¾ inches

New Note 3 added following paragraph (b-8) to avoid the use of non-approved bottom rod and brake beam safety supports, and in lieu thereof replacement of such supports with A.A.R. Recommended Practice designs or with Approved Equivalent types, when cars are in owners shops or repair tracks.

Paragraph (d-1)—Third note following this paragraph modified to include Waugh-Gould 451 draft gear as being approved for cars of special construction.

Paragraph (d-4)—Draft key retainer—Modified to indicate requirement therein is effective January 1, 1953, no further extension being granted.

Paragraph (f-2)—New paragraph added to require the use of additional anchorage items on flat cars built new or rebuilt on or after January 1, 1954, from owners.

Paragraph (j-3)—Modified by changing 15 month requirement to 18 months account changes in Rule 66 involving restoring previous periods for repacking journal boxes, as shown in Supplement No. 1 to the 1952 Code.

Paragraph (j-4)—Journal box lids—Modified to provide for subsequent revisions in the 1947 Specifications for Journal Box Lids.

Paragraph (r-7)—Additional type of metal running board added to group one of this paragraph, as shown in Supplement No. 1 to the 1952 Code.

Paragraph (s-6)—New paragraph added with respect to stencilling car initials and number on each truck bolster, to facilitate the identification of trucks separated from cars at wrecks and to conform with the requirements of Section "L" of the Manual of Standard and Recommended Practices.

Paragraph (t-3-f)—Cars equipped with cast steel truck side frames to which repair patches or reinforcing plates have been applied prohibited in interchange, effective January 1, 1953. From owners.

Paragraph (t-11)—Paragraph, having reference to rejection from owners of tanks having tank or safety valves due for testing within 30 days, eliminated account not in compliance with I.C.C. Specifications. Requirements with respect to testing tank and safety valves as specified in Paragraph (t-12) will govern.

Paragraph (w-3)—Modified, account no further exten-

sion for the requirement contained in Paragraph (w-4), which has been eliminated, pertaining to single plate non-bracketed 700 and 750 lb. cast iron wheels. Such wheels prohibited in interchange regardless of date cast.

Rule 9

Wheels and Axles, R&R—New last paragraph added account changes in Rules 71 and 75 involving the condemnation of cast iron wheels. Repair card must show purpose for which car is shopped when wheels are condemned by any of the reduced dimensions shown in Rules 71 and 75 (b-1).

Journal Boxes, Friction Bearings, Periodic Repacking, etc.—Reference to packing period changed from 12 months to 15 months in line with modification in Rule 66, as shown in Supplement No. 1 to the 1952 Code.

Journal Box Lids, Applied—Modified, to provide for subsequent revisions in the 1947 Specifications for journal box lids.

Rule 16

Second paragraph modified to eliminate the possibility of railroads doing improper caulking of seams and rivets on tanks of tank cars, as shown in Supplement No. 1 to the 1952 Code.

New fifth paragraph added to provide for the stenciling and handling of covered hopper cars having special interior protective coatings.

Rule 17

Paragraph (e)—New Note 11 added to insure the application of brake beams of sufficient length to properly fit truck sides equipped with brake beam safety ledges.

Paragraphs (i-1), (i-6) and Note following Int. (C-2)—Modified providing for permissible substitution and handling of conditionally approved National Rubber Cushioned Type MF-260 draft gears, as shown in Supplement No. 1 to the 1952 Code. These paragraphs and Note further modified to include additional approved National Rubber Cushioned Type MF-275 draft gears.

Paragraph (m)—Modified to avoid the use of bottom rod and brake beam safety supports which are difficult to properly maintain and which are frequently found defective. A.A.R. Recommended Practice designs must be renewed in kind or substituted one for another or may be substituted for A.A.R. Approved Equivalent designs. A.A.R. Approved Equivalent designs standard to car may be renewed in kind or substituted one for another and this type of brake beam safety support having brake beam release or leveling features must be renewed in kind or substituted with A.A.R. Recommended Practice designs. Substitution of A.A.R. Approved Equivalent designs for A.A.R. Recommended Practice designs constitutes temporary repairs, no bill.

Int. (B-8)—New last sentence added with respect to responsibility for main or auxiliary springs missing when design of support is such that it is impossible to lose only one of the springs.

Rule 19

Item 10—Reference to "secondhand" or "secondhand rebroached" journal bearings eliminated to conform with present requirements of the Lubrication Manual, also to eliminate penalty placed in 1952 Code where applications of such bearings were made. See new Note following Rule 62.

Item 19—Reference to date cast eliminated account revision of Paragraph (w-3) of Rule 3.

Rule 22

Paragraph 11—Second paragraph modified and new sentence added to note in Fig. 13-I to permit the R&R of draft gear or yoke without disturbing splice plate.

Rule 24

New rule added to prohibit the application of separable journal boxes or truck side frames with integral journal boxes worn to limits condemnable by gages shown in new figures 1, 2 and 3 of this rule.

Rule 25

New rule added providing for renewal of truck side frames which are badly corroded or badly worn. Such defective side frames must be held and reported to car owner for disposition.

Rule 49

Paragraph (c)—Second paragraph modified to provide more accessible location for cardboards on other than house cars.

Rule 60

Paragraph (f)—New last sentence added covering air brake stencil on tank cars, to avoid obliteration of air brake markings caused by spillage of certain commodities from domes of tank cars.

Paragraph (l)—New item added to Note 2 following this paragraph to require application of non-metallic emergency graduating valve when air brakes receive periodic attention, to further stabilize the "AB" valve against undesired emergency application.

Note 4 following this paragraph eliminated, account condemnation of gaskets now being by use of gage instead of on an arbitrary basis.

New Note 6 added providing that new air hose gaskets must be applied when air brakes are given periodic attention.

Former Notes 5 and 6 of paragraph (1) renumbered to 4 and 5 account elimination of former Note 4.

Paragraph (n)—Note following this paragraph modified to provide additional reference as to air brake pamphlets governing air brake work.

Rule 61

Paragraph (a)—Modified to provide that necessary attention must be given to truck details when car has one or more trucks R&R for any reason, as shown in Supplement No. 1 to the 1952 Code.

Rule 62

Third paragraph modified to enforce compliance with current A.A.R. Specifications for journal bearings to justify bill.

New note added following third paragraph providing that when wheels are changed, secondhand or secondhand rebroached journal bearings must not be applied or removed and replaced regardless of responsibility for wheel change and where secondhand or secondhand rebroached bearings are used in connection with handling line responsibility for wheel change, defect card must be issued for labor and material covering such journal bearings.

Rule 66

Paragraphs (a), (f), (g-1), (g-2) and Int. 2—Repacking periods changed from twelve (12) to fifteen (15) months and from eleven (11) to fourteen (14) months when car is on repair track for other work, as shown in Supplement No. 1 to the 1952 Code.

Paragraph (h)—New note added to indicate the use of reclaimed Diesel filter waste in any form is prohibited, as shown in Supplement No. 1 to the 1952 Code.

Int. 4—New last sentence added to first note following this interpretation to provide suitable stenciling for protection to cars equipped with Plypak and Flexpak waste containers.

Rule 70

Paragraph (f)—Modified to clarify the intent that when multiple wear wrought steel wheels are substituted for one wear wrought steel wheels, standard to car, or when one wear wrought steel wheels are substituted for multiple wear wrought steel wheels, standard to car, handling line responsibility, charge must not exceed secondhand value of one wear wheels.

Paragraph (g)—Modified to provide that when one wear or multiple wear wrought steel wheels are applied by intermediate line, on authority of defect card, in place of cast iron wheels standard to car, company responsible for wheel exchange must assume difference between value of cast iron wheels removed (unless condemned by owner's defect) and value of steel wheels applied, in cases of slid flat wheels as well as in cases of wheels removed account cut journal.

Rule 71

First paragraph modified to provide for the removal and condemnation of cast iron or cast steel wheels with shelled-out spots 2 in. or over when car is on repair track for other work. Billing repair cards in such cases must specify purpose for which car was shopped.

Rule 73

Note 3, which prohibited the condemnation of wheels by the use of Worn-through-Chill or Out of Round Gage in train yards, has been eliminated. This gage may now be used in train yards.

Rule 75

Paragraph (b-1)—Modified to provide for the condemnation of cast iron wheels with brake burn comby spots 2 in. long or over or 2 such adjoining spots 1½ in. or over, when car is on repair tracks for other work. Billing repair cards in such cases must specify purpose for which car was shopped.

Rule 76

Second paragraph modified account adoption of new design wrought steel wheel gage and new simplified steel wheel gage. Reference to gage in first paragraph changed from Fig. 4-F to Fig. 4-H, as mentioned below.

Rule 79

First paragraph modified account adoption of new design wrought steel wheel gage and new simplified steel wheel gage.

Rule 82

Paragraph (b-4)—Modified to provide for the removal and condemnation of cast iron wheels with 2 comby spots instead of former requirement of 3 comby spots.

Wheel Gages

Fig. 1—Modified account revision of condemning limits for wheels in line with revision in Rule 75, paragraph (b-1), to permit measuring 1½ in. comby spots.

Fig. 4-E—New note added to this Figure providing that steel wheel gage indicated by this Figure may be used for determining limit for flange height until new design steel wheel gages are obtained.

Fig. 4-E-1—New design of wrought steel wheel gage referred to in second paragraph of Rule 76.

Fig. 4-F—New simplified steel wheel gage for use in freight car service as referred to in Rule 79.

Fig. 4-G—New simplified steel wheel gage to check condemning limit for flange height, as referred to in second paragraph of Rule 76.

Fig. 4-H—Renumbered from Fig. 4-F account addition of new gages mentioned above.

Rule 86

Paragraph (a)—New sentence added to second paragraph pertaining to maximum load limits in tank cars, to bring this rule in conformity with I.C.C. regulations.

Table covering tubular axles—Axle dimensions in column W, limits of wear changed to allow a wear limit of ⅛ in. from new dimension at center of axle.

Rule 87

Int. 1—Modified to indicate that splicing of main flooring is also classed as temporary repairs.

Rule 88

Int. 7—Modified to provide charges and credits where National Rubber Cushioned Type MF-260 draft gear is missing; also modified increasing credit for this type of gear and Waughmat Twin Cushioned gear and yoke from 50 per cent to 75 per cent of value new, as shown in Supplement No. 1 to the 1952 Code. This interpretation further modified to include National Rubber Cushioned Type MF-275 draft gears.

Rule 91

Int. 3 and 5—Modified to clarify the intent and to bring in harmony with the intent of Paragraphs (b) and (c) of this rule.

Rule 92

First paragraph modified to more clearly indicate against whom bills are to be rendered.

Rule 94

Second paragraph modified account modification of Paragraph (1-c-3) and addition of new Paragraph (1-d-2) of Section A of Rule 112, as shown in Supplement No. 1 to the 1952 Code.

Rule 98

Paragraph (c-2)—Modified to indicate that this paragraph covers all single plate non-bracketed cast iron wheels, (excluding the 650 lb. size regardless of date cast.)

Paragraph (c-5)—This paragraph, having reference to single plate non-bracketed cast iron wheels (excluding the 650 lb. size) cast in 1938 or subsequent thereto, eliminated account modification of Paragraph (c-2) of this rule.

Paragraph (c-6) and (c-8)—Renumbered to Paragraphs (c-5) and (c7) account elimination of former Paragraph (c-5).

Paragraph (f-4)—Modified to indicate that this paragraph covers cases where multiple wear wrought steel wheels *standard to car* are removed and/or applied and to eliminate confliction with Paragraph (g) of Rule 70.

Int. 4—Modified to indicate that this interpretation also covers cases where cast iron or cast steel wheels are applied in place of one wear wrought steel wheels standard to car.

New third paragraph added to first Note following Interpretation 4 to provide method to be followed in charging for repairs where made by intermediate line on authority of defect card.

Rule 101

In addition to changes in prices shown in Supplement No. 1 to the 1952 Code, further price modifications have been made on a number of items as a result of subsequent material quotations.

The following additions and modifications are also directed to your attention:

Item 36-A—New item to provide charge for retaining valve wasp excluder applied separately.

Item 101-B—Note following this item eliminated to permit application of Wabcoseal fittings to cars under all conditions, as shown in Supplement No. 1 to 1952 Code.

Items 104-C, 104-D, 105-A and 105-C—Modified to provide for subsequent revisions in the 1947 Specifications for Journal Box Lids. Items 105-A and 105-C also modified to provide charge for 12 in. journal box lids, as shown in Supplement No. 1 to the 1952 Code.

Item 169-I—Fourth Note following this item modified to limit charge where all packing retainer devices are R&R or R, as shown in Supplement No. 1 to the 1952 Code.

Item 221 and Brake Beam Identification Tables—New Item added to provide for new type of A.A.R. No. 18 Brake Beam bearing certificate No. 67, and new diagram added to Fig. 2 to cover.

Friction Draft Gears—Note preceding draft gear prices modified in preamble form, to provide average credits for approved and non-approved type of draft gears on the basis of separate arbitrary allowance for each class, regardless of extent of defective condition of gears removed, as shown in Supplement No. 1 to the 1952 Code.

Paragraph 8—Modified to include National Rubber Cushioned Type MF-260 draft gears, as shown in Supplement No. 1 to the 1952 Code. This paragraph further modified to include National Rubber Cushioned Type MF-275 draft gears.

Item 250-C—Modified to cover Hulson 202 Modified and 202-A (both conditionally approved), in place of Hulson 202 which has been transferred to Section II as new Item 252-B, as shown in Supplement No. 1 to the 1952 Code.

Items 250-E-1 and 250-J—Modified by elimination of words "conditionally approved," as shown in Supplement No. 1 to the 1952 Code.

Item 250-H—Modified to cover Peerless D-A draft gear, as shown in Supplement No. 1 to the 1952 Code. This item subsequently modified to eliminate reference to Peerless D-A gear and new Item 250-H-1 added to cover conditionally approved Peerless D-A gear.

Item 250-L—Note 3 following this item modified by elimination of words "conditionally approved," as shown in Supplement No. 1 to the 1952 Code.

Note 5—New Note added to cover conditionally approved National Rubber Cushioned Type MF-260 draft gears, as shown in Supplement No. 1 to the 1952 Code. This Note subsequently modified to include reference to National Rubber Cushioned Type MF-275 draft gears.

Item 250-Q—New item added to Section 1-A to provide price for Waugh-Gould 451 draft gear and Note following modified to include reference to this gear, as shown in Supplement No. 1 to the 1952 Code.

Items 251-D, 253-G and 253-J—Modified to include additional types of non-approved draft gears, as shown in Supplement No. 1 to the 1952 Code.

Additional type of geared hand brake added to Table covering A.A.R. Approved Types of Geared Hand Brakes.

Additional approved types of journal box lids added to Table covering A.A.R. Approved Type of Journal Box Lids, as shown in Supplement No. 1 to the 1952 Code.

New Table added covering list of A.A.R. Approved Equivalent Brake Beam Safety Supports, the use of the Universal brake beam safety support being permitted only for replacement in kind until August 1, 1953.

Table covering list of Packing Retainer Devices modified account certain changes in design.

Rule 107

Various labor allowances and combination labor and material allowances were modified in Supplement No. 1 to the 1952 Code. In addition, labor allowances and combination labor and material allowances were further modified on basis of semi-annual survey of material prices and annual survey covering rates of pay and classification of employees engaged in repairing cars.

Item 56—Modified to clarify the intent that in cases of refrigerator cars this item applies to hinged type side doors.

Item 56-A—New item added to provide labor charge for R&R of sliding type door on refrigerator car.

Note following Item 56 relocated to follow Item 56-A, to indicate it applies to both Items 56 and 56-A.

Item 100-A—Modified to indicate that charge can be made for R&R of packing retainer device in connection with R&R or R of wheels or other truck parts.

Rule 111

Item 10—Modified to indicate charge also applies to release control retainer cleaned and tested, as shown in Supplement No. 1 to the 1952 Code.

Items 13, 14, 15 and 15-A—Modified to provide for the material cost of two air hose gaskets which must now be arbitrarily renewed when air brakes receive periodic attention. The allowances in Items 15 and 15-A were further modified account elimination of Note 4 following Paragraph (1) of Rule 60.

Rule 112

Section A, Paragragh (1-c-3)—Modified to emphasize that entire car, including trucks, shall be sent home loaded on another car or cars where owner requests return of damage car. Also modified to discourage the practice of unnecessarily cutting up badly damaged cars to facilitate handling and to prohibit disposal of such cars or parts without express authority from owner who must be extended privilege of inspecting car if so desired, as shown in Supplement No. 1 to the 1952 Code.

Paragraph (1-d) and Note 2 thereof—Modified in line with new Paragraph (1-d-2) shown below, as shown in Supplement No. 1 to the 1952 Code.

Paragraph (1-d-2)—New paragraph added to provide penalty against handling line where it fails to return one or both trucks where damaged cars are sent home for repairs loaded on another car or cars, as shown in Supplement No. 1 to the 1952 Code.

Section B—Per pound prices in Paragraphs 1 and 8 modified and new per pound prices incorporated in Paragraph 8 for additional classes of tank cars, as shown in Supplement No. 1 to the 1952 Code.

Second note in Table under Paragraph 1 modified to adequately reimburse car owner for "LO" hopper cars badly damaged or destroyed on foreign roads which have certain parts of stainless or stainless clad steel.

New third note added to Table under Paragraph 1, to provide additional allowances for special interior protective coatings of covered hopper cars when destroyed or extensively damaged on foreign lines.

Section B, Paragraph 4—New sentence added providing for settlement for flat cars in excess of 200,000 lb. nominal capacity and flat cars of any capacity having depressed center or well hole.

Paragraph 5—New paragraph and note following added to provide equitable basis for refrigerator cars destroyed which are equipped with mechanical refrigeration.

Former Paragraphs 5 to 9 renumbered as Paragraphs 6 to 10 in line with above.

Section J—Modified to permit car owners to recover desired serviceable or repairable special parts of certain flat cars badly damaged or destroyed on foreign lines.

Rule 122

Int. 7—Modified to indicate conditionally approved National Rubber Cushioned Type MF-260 draft gears must be furnished by repairing line, as shown in Supplement No.1 to the 1952 Code. This interpretation further modified to include National Rubber Cushioned Type MF-275 draft gears.

Passenger Car Rules

Rule 2

Paragraph (e) and (f)—Effective dates of these paragraphs, with respect to application of defect cardboards and application of brake shoe spark shields, extended to January 1, 1954, as shown in Supplement No. 1 to the 1952 Code.

Paragraph (k)—New paragraph added to require the application of A.A.R. standard type H couplers to passenger equipment cars built new on and after January 1, 1954.

Paragraph (l)—New paragraph added to provide reference for designation of sides, ends, journals and journal box locations on passenger train cars.

Rule 7

Paragraph (e-1)—Second paragraph modified to indicate repairing line is not penalized for substituting an A.A.R. axle when removing a non-A.A.R. axle.

Paragraph (f-4)—Modified account adoption of new design wrought steel wheel gage, and new simplified steel wheel gage.

Paragraph (f-12)—Third paragraph modified account adoption of new design wrought steel gage and new simplified steel wheel gage.

Paragraph (j-3)—New paragraph added making mandatory inspection, testing and lubrication of hand brake mechanism and connections when car is on shop or repair track for cleaning of air brakes, as shown in Supplement No. 1 to the 1952 Code.

Rule 21

Labor allowances and combination labor and material allowances were modified in Supplement No. 1 to the 1952 Code. Major combination items and labor items were subsequently modified on the basis of semi-annual survey of material prices and annual survey covering rates of pay and classification of employees engaged in repairing cars.

Rule 22

In addition to changes in prices shown in Supplement No. 1 to the 1952 Code, additional price modifications have been made on a number of items on the basis of semi-annual survey of material prices and annual survey of rates of pay and classification of employees engaged in repairing cars.

Items 40 and 40-A—Modified to indicate allowances for steam connector coupler head includes price for gasket, as shown in Supplement No. 1 to the 1952 Code.

Note 2—Second paragraph of this Note modified to indicate scrap value only to be allowed for non-A.A.R. axles having 5½ x 11 inch journals.

■ ■ ■

The versatility of the standardized diesel locomotive as developed by Electro-Motive Division of General Motors was exemplified in shipments of "F" type General Motors locomotives to Saudi Arabia and to Alaska within a few days of each other at the turn of the year. The locomotives are the standard 1500-hp. freight locomotive units used in the United States, each with the same basic power plant, transmission, car body, trucks and controls but with variations in equipment that make one set of locomotives able to cope with the extreme heat and dust conditions of the Arabian desert and the other to operate successfully in the sub-zero and heavy snow and ice conditions of central Alaska. Two units which went to the Saudi Arabian Government Railroad will operate combination freight and passenger trains over the 370 mile line between Bahrein and the capitol city Riyadh. Before the establishment of this railroad shortly after the close of World War II by the Arabian American Oil Company, all supplies from the sea coast went to the capitol by camel train. The units are painted bright green and white for high visibility against the sand of the country they will traverse, with the crossed sabres and palm tree insignia of the railroad on their noses. They have insulation and cab-ventilating equipment and special air filters to protect engines from dust and sand. Six units for the Alaska Railroad will operate as three two-unit 3,000-hp. locomotives hauling freight between Anchorage and Fairbanks and Anchorage and Seward. They have snow-plow pilots and special winterization equipment in the engine room to prevent freezing and icing of the engine cooling system, fuel and lubricating lines.

ELECTRICAL SECTION

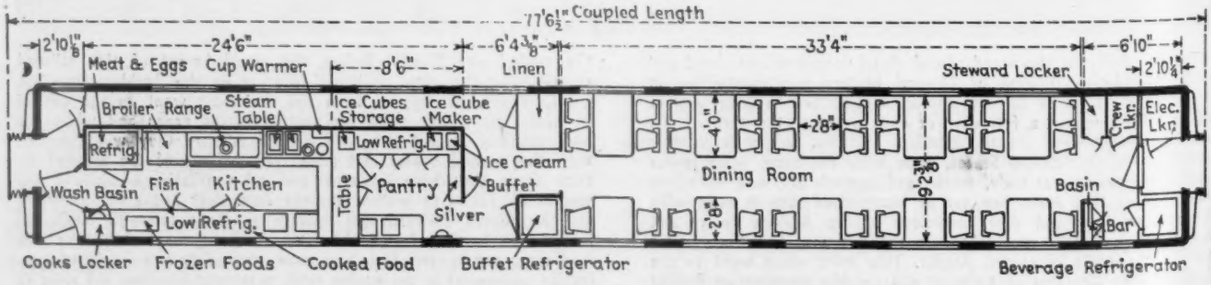
One of the reconditioned diners in service.

N.&W. Dining Car Refrigeration

EIGHT dining cars are now being reconditioned by the Norfolk & Western to improve the quality of the service including the use of frozen foods. In the process, the cars are being redecorated, and equipment in the pantry and kitchen rearranged to facilitate working conditions. It is difficult to meet the requirements of public health authorities with ice refrigeration, and this problem is relatively simple when the cooling and freezing are done with freon compressors and evaporators.

To provide desirable dining car refrigeration, the cars are being equipped with two low temperature or deep freeze boxes operating between 0 and 10 deg. F., and five refrigerators which maintain temperatures between 28 and 34 deg. F. The two low-temperature boxes are used respectively for frozen food storage and for ice cream. The refrigerators are used for (1) ice cube making, milk storage and ice cube storage, (2) meats and eggs, (3) fish and cooked food storage, (4) fruits, lettuce and vegetables, and (5) beverages.

The meat, the buffet and the beverage refrigerators have their own self-contained refrigerating units. The other refrigerators are supplied from two General Elec-



Plan showing the arrangement of equipment in the cars.

The Edison battery consists of 88, type A12H cells carried in 3 battery boxes, two of which are shown here.

The Safety 5-kw. motor alternator and one of the 2, 15-kw. Safety generators with Spicer drive.

One of the two General Electric undercar refrigerating units.

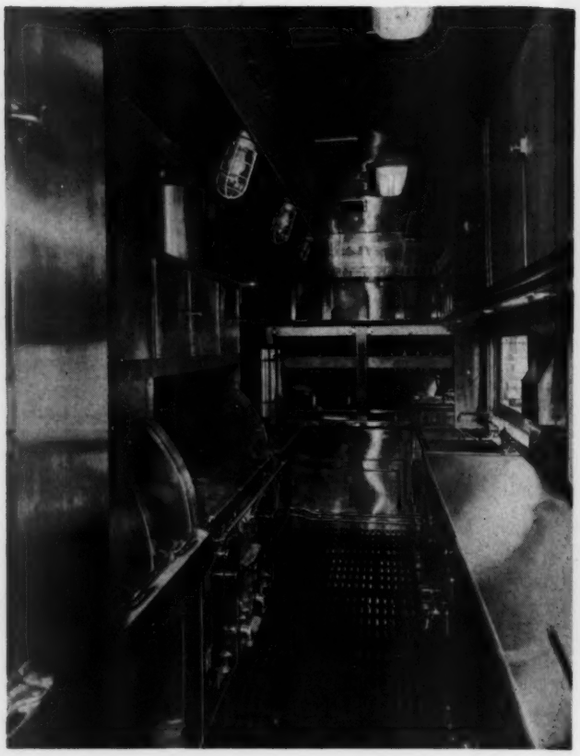
The dining section is lighted by 20, 40-watt fluorescent lamps, supplemented by 20, 15-watt incandescent lamps.

Ice cream storage, ice cube maker, milk, syrup and fruit juice storage and ice cube storage are all in the pantry and supplied by one undercar unit. The toaster may be seen at the right.

tric undercar units which also serve the deep-freeze boxes. Regulating valves in the freon lines hold the temperatures at the refrigerating values desired. The ice cube maker, for example, operates at a lower temperature than the ice cube storage box, and the ice cream deep freeze operates at a temperature lower than either of the other two, but all are supplied by the same compressor. The deep freeze boxes are maintained at temperatures between 0 to 10 deg. F. No difficulty has been experienced on those cars which have been placed in service, in keeping up with the demand for ice cubes. All refrigerator and deep freeze boxes were supplied by Angelo Colonna and Company, Philadelphia, Pa., and all refrigeration units by the General Electric Company.

It has been the experience of the railroad that refrigerating units on dining cars require greater motor capacity than the same units in stationary service operated by motors supplied with power from a public utility. For that reason, the motors selected for use on the cars have about twice the capacity of those with which the units were originally equipped.

The two undercar units are operated in cold weather with a solid back and a louvered shutter. In the summer,



In the kitchen there is a low temperature box for frozen foods and refrigerators respectively for fish and cooked food. All three are supplied by one undercar unit.

the back is removed and the shutter opened. If the ambient temperature should drop below the temperature corresponding to the operating pressure of the unit, the unit would not start on demand. To provide for this, the receivers are each equipped with a 100-watt heater strip which goes into service automatically with the operation of the floor heat control. The heaters are strapped to the receivers and covered with asbestos.

Connected Load

In addition to refrigeration, the electric load includes a 6-ton Frigidaire refrigeration unit, operated by a 10-hp. d.c. or a 15-hp. a.c. motor, 955 watts of fluorescent light load, 775 watts of incandescent lights, a 2400-watt toaster and 2 hp. in blowers.

The main blowers are operated on direct current while all other blowers, including those for kitchen ventilation and the toaster and the fluorescent lights, are operated on alternating current. All d.c. power, except that for the air conditioning motor is regulated. The toaster is operated on a.c. power since it permits of better automatic control.

Each of the underframe refrigerating units is driven by a ¾-hp. motor, and the three self-contained units have two ⅓-hp. motors and one ½-hp. motor, the larger one being used for the beverage refrigerator.

Power Supply

To meet the added power requirements, the car was equipped with a second 15-kw. Safety 115-volt d.c. axle generator and Splicer drive, one generator being driven from each truck. A.c. power is supplied by a 5-kw. Safety motor alternator.

The battery size was increased from 88 cells of A-8-H

Left: When the car is in service a small panel in the electrical locker door can be opened, permitting operation of temperature controls and branch circuit breakers, yet preventing contact with any live circuits. Right: Interior view of the electrical locker.

Edison batteries to the same number of A12H cells. They are carried in two battery boxes, with 60 cells in one box and 28 in the other. It was possible to use the original boxes. This was done by a somewhat closer spacing of cells in the trays, elimination of bumper blocks, and the substitution of pull plates for chest handles.

Axle generators are operated in parallel. Variations due to voltage regulator settings and differences in wheel diameter may cause one generator to carry all of a small load, but when there is sufficient load for both generators, it is divided equally.

In the process of reconversion, all cars are being rewired with Okonite Okoprene wire and cable. Separate circuits are run from the distribution panel to each refrigerating unit and to the toaster. Ample size conduits are used.

Fluorescent lights are 115-volt. For their power supply, the 3-phase, 230-volt output of the motor generator is stepped down in the locker by a transformer to the 3-phase, 115-volt power and the load is balanced over the phases.

In the dining section, there are 20, 40-watt fluorescent tubes placed behind diffusing glass panels, 5 on each side of the clerestory and 5 under each lower deck. There are also 20, 115-volt, 15-watt incandescent lamps, 10 on each side, supplied by regulated d.c. power. Lighting in the buffet section is furnished by 2, 40-watt fluorescent lamps and one 100-watt incandescent lamp; in the pantry by one 15-watt fluorescent lamp, and in the kitchen by 4, 15-watt fluorescent lamps and 3, 100-watt incandescent lamps. The passageway is lighted by 3, 25-watt incandescent lamps.

All a.c. motors are 3-phase, 230-volt motors. When the car is on standby power, the air conditioning compressor is driven by the a.c. motor, and the d.c. motor runs as a generator to supply about 40 amp. of d.c. current. This is sufficient to operate the main blowers.

The modernization work is being done in the railroad's Roanoke, Va., shops.

LANDSCAPED WIRE. What appears to be an artist's conception of a landscape showing a lonely tree and prairie shrubs silhouetted against a heavily overcast sky is actually the cross section of a wire no larger in diameter than the lead in a pencil. Magnified 100 times, this wire was photographed with special equipment at the testing laboratory in General Electric's Locomotive and Car Equipment Department in Erie, Pa. The trees and shrubs are actually corrosion spots on the surface of the wire which, unless spotted in production, could cause the wire to snap and result in costly equipment breakdowns.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

18 The Locomotive Excitation System

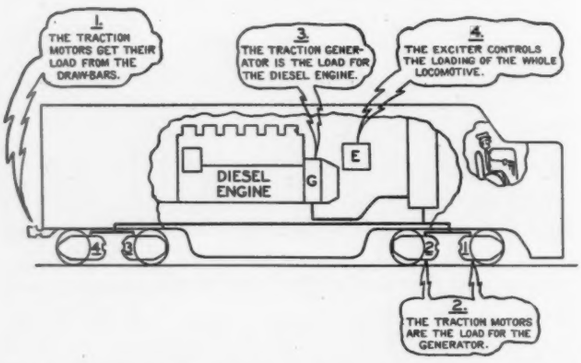

1
THE TRACTION MOTORS GET THEIR LOAD FROM THE DRAWBARS.
3
THE TRACTION GENERATOR IS THE LOAD FOR THE DIESEL ENGINE.
4
THE EXCITER CONTROLS THE LOADING OF THE WHOLE LOCOMOTIVE.
DIESEL ENGINE
G
E
2
THE TRACTION MOTORS ARE THE LOAD FOR THE GENERATOR.

Fig. 1—How locomotive load travels from drawbar to diesel engine

How one type of excitation system works and what you can do about it when it doesn't work as it should

IF YOU have ever seen someone try to handle a team of wild horses, you know they don't get much work done. On the other hand, the milkman's horse goes about his job almost automatically. Both of these are horsepower, but one is out of hand while the other is controlled.

A diesel-electric locomotive has the power of many hundreds of horses. If it were not controlled, it would act much like the wild team. The idea is to make it act like the milkman's horse. The excitation system and the governor work as a team to do this. The excitation system is to the traction generator what the governor is to the diesel engine. They both work to get the most power out of the locomotive without overloading any part so that it is damaged.

Controlled Performance

To understand how this job is done, let's take a quick look at locomotive performance. It is made up of two factors: load and speed. The locomotive picks up its load at the drawbar, Fig. 1. Since the traction motors are used to move the locomotive and pull the train, they take on this load. The more current flowing in the motors, the harder they pull, and the greater load the locomotive will handle. But, the more current flowing the hotter the motors will get. If the heavy current lasts too long, the motor winding insulation will be damaged. So we see that motor capacity fixes the load the locomotive can handle.

On the other hand, once a train is started you want to get it up to speed as soon as possible. The top speed, and how fast you get up to it depends upon the diesel engine horsepower. The more power it can put out, the faster the train will come up to speed and the higher its top speed will be. So we see that the horsepower the diesel engine can put out fixes the locomotive speed.

To put a load on the diesel engine, you connect the generator to the traction motors, Fig. 1. Then you pass current through the generator field. This causes the generator to put out electrical power. Cables deliver this power to the traction motors. These are the load for the generator. Thus, by controlling the generator field, you can control the power taken from the engine and delivered to the motors. Increasing the field current increases the power delivered by the locomotive. Decreasing the field current decreases the power. So the generator field is really the key to changing the locomotive from a "bucking broncho" to the "workhorse" of the railroad. Now let's see how we control the generator field.

Generator Field Control

An exciter *E*, Fig. 2, supplies the generator field current. This is a small generator, driven by the engine through gears or belts. We might use a rheostat for controlling the current flow to the generator field. Since this current may be as large as 85 amperes, the rheostat would be bulky. Considerable force would be required to operate it. To get away from this, the rheostat could be put in the field of the exciter instead, Fig. 2. Here it handles only a little current and can be quite small. By controlling the exciter field you can control the exciter output that goes to the main generator field. Then varying the exciter field will control the main generator output.

On Alco-G. E. locomotives the control job is made even easier by using a special type of exciter, called an amplidyne. When it comes to operation and maintenance this can be treated just like any small d.-c. generator. Its big advantage is that a very small change in its field current produces a large change in its output. By varying the amplidyne field from 0 to 0.6 ampere you can control the main generator output over its entire range. This is about half the power required to run an electric clock,

* This is Part I of the eighteenth of a series of articles on maintenance of diesel-electric equipment. This article is written by B. L. Judy and A. V. Johansson, both of the Locomotive and Car Equipment Department, General Electric Company, Erie, Pa. Part II will appear in the July 1953 issue of *Railway Locomotives and Cars*.

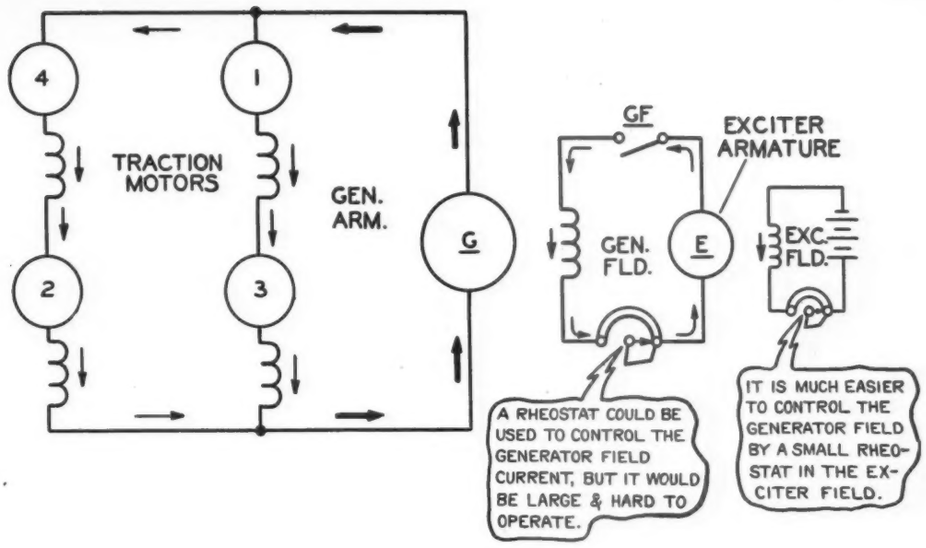


Fig. 2—Two possible locations for the generator field rheostat

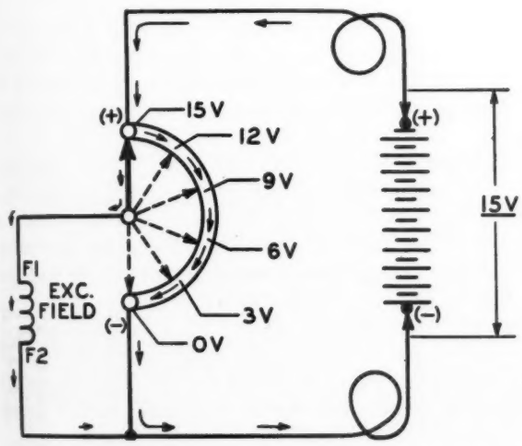


Fig. 3—How a potentiometer can be used to vary exciter field voltage

yet with it you can control the whole locomotive—one mousepower bosses 2,250 horsepower!

The electric parts that handle locomotive power are large. And, you know, large bodies move slowly. If they are used to control horsepower, we are likely to have a sluggish locomotive. On the other hand, the mousepower of the amplidyne exciter is easy to handle. It can be controlled by small, lightweight, quick acting parts. This gives snappy locomotive performance.

Exciter Field Control

Now let's find out what controls the exciter field. This job is done by a couple of simple electric circuits. We'll show how each works and then how they work together.

First we must get acquainted with a potentiometer. Don't let the name worry you. It is just a variable rheostat used where a wide range of voltage and little power is needed. Suppose you connect a rheostat across a battery as shown in Fig. 3. The top of the rheostat will be positive, and at 15 volts. The bottom will be negative, and at zero volts. This means that the voltage drops off as you move down the rheostat. You can prove this by measuring with a voltmeter at different points, Fig. 3. So, by turning the arm you can pick off the rheostat any voltage you need from 15 down to zero.

Potentiometers have many uses in electric circuits. Here we use it to vary the voltage across the exciter field. This, in turn, controls the current through the field. In fact, this is the load control rheostat we learned about when studying the governor. You may recall that the brush arm is controlled by the governor speed pilot valve. When the governor is operating in load control, it holds engine speed by increasing or decreasing the exciter field current. This amounts to varying the load on the engine.

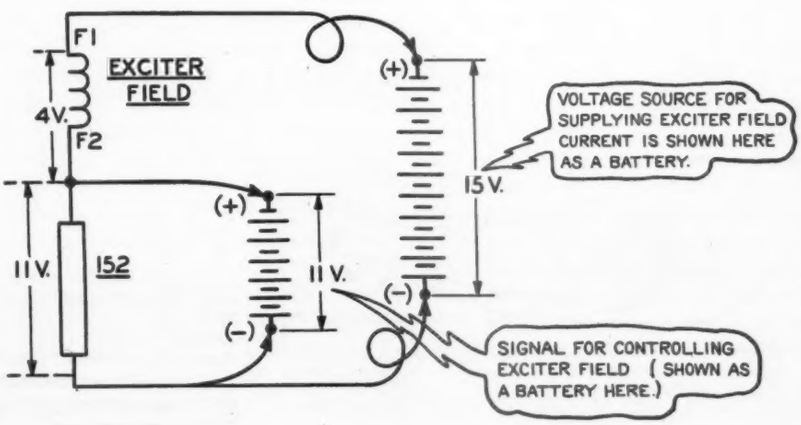


Fig. 4—Exciter field voltage can also be varied by changing the voltage across a resistor in series with the field

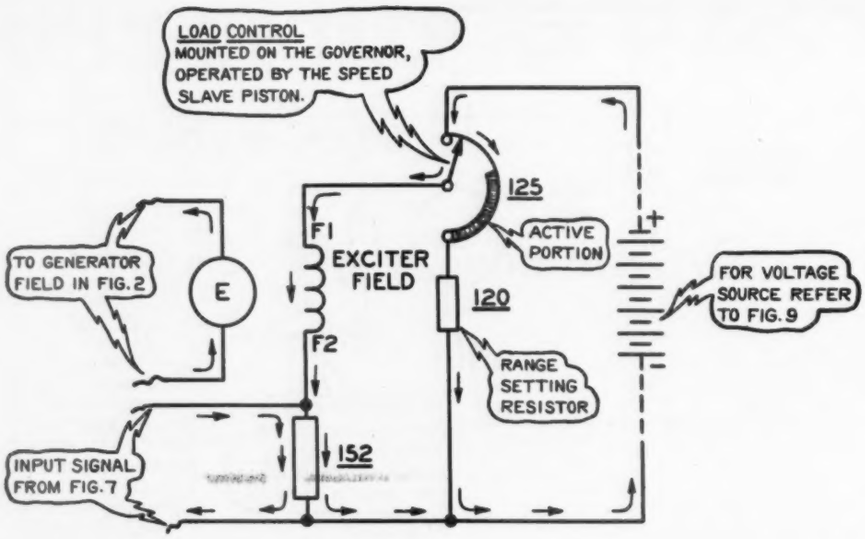


Fig. 5—An exciter field control circuit combining the methods shown in Fig. 3 and Fig. 4

A second way of controlling the exciter field is shown in Fig. 4. In this case the exciter field and a resistor are connected together. If you connect a battery to them, the total battery volts will appear across the two. If you measure the voltage across the field and across the resistor, you will find that the two always add up to the battery voltage. This must always be true. In the example, Fig. 4, the 11 volts across the *152* resistor and the 4 volts across the field add up to the 15 battery volts. Now let's connect a source of voltage across the *152* resistor. Suppose we use a second battery. If we make this battery 11 volts, nothing will happen. If we raise it to 12 volts we will have 12 volts across the *152* resistor. Now this, plus the exciter field volts must still add up to 15. So, the exciter field voltage must now be 3. By adding 1 volt across the resistor, we have reduced the exciter field volts by 1. If we bring the voltage across the resistor up to 15, we will force the exciter field voltage down to zero. Thus, by varying the voltage across the *152* resistor, we can control the exciter field voltage. This method is quite convenient because it does not require any moving parts.

On the locomotive we feed signals to the *152* resistor to vary the exciter field voltage. This is used to limit the traction motor current when the locomotive is starting a train. It is also used to hold down the main generator field current in high-speed operation. Later we will see how these signals are fed to the resistor.

Figure 5 shows the circuits of Figs. 3 and 4 combined. Now you can see how the load control potentiometer *125* raises and lowers the exciter field voltage. This allows the governor to control the engine load and get full horse-

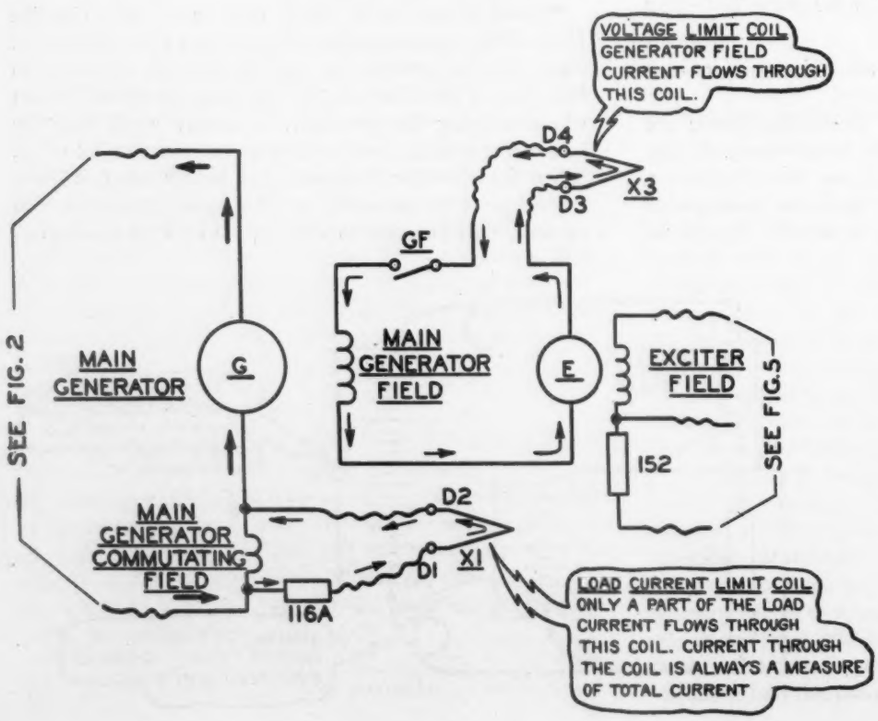


Fig. 6—How voltage signals for generator current and voltage control are obtained

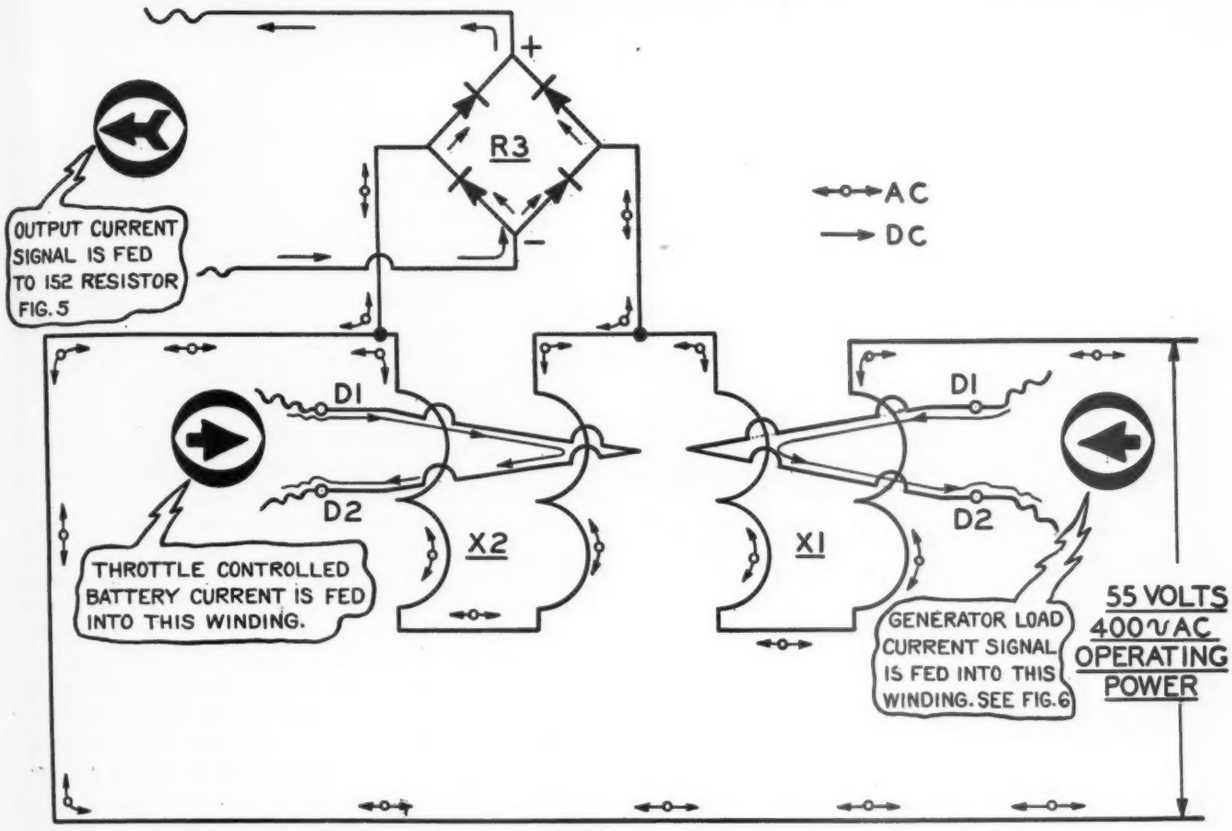


Fig. 7—Reactors and rectifiers are used to deliver the signals to the resistor shown in Fig. 5

power out of the engine. Main generator load current and field current signals are fed into the *152* resistor. These control traction motor starting current and top generator voltage. In this way we can do three things. First—limit traction motor starting current. Second—control the load on the diesel engine. Third—limit the top voltage that the traction generator can deliver.

The voltage across the *152* resistor puts the ceiling on generator output current and voltage. Let's see where this voltage comes from. Figure 6 shows where the controlling currents (often called limit signals) are picked up. CURRENT LIMIT. In starting a locomotive you want to have control of the current being fed to the traction motors. This is because very high currents can easily flow to the traction motors at low speeds or standstill. If these currents are not under the control of the engineer, the locomotive may "take the bit in its teeth" and pull a drawhead.

As you see in Fig. 6, we get the load current signal by allowing a little of this current to flow through the coil marked *X1*. In a minute we will see what the *X1* coil does with the signal. Right now the important thing is where the current comes from and the fact that it is a measure of the generatorload current.

VOLTAGE LIMIT. As the locomotive speeds up, the generator voltage increases and the load current drops off. More generator field current is required to produce the higher voltages. If no limits were set, the generator field current could go sky high. If it is allowed to go too high the field insulation will be damaged or burned up. The high field currents also produce high generator voltages. As you know, high voltage, like high pressure, can also cause trouble. We want to protect against both overheating and high voltage. To do this, we put a ceiling on the main generator field current. The coil marked *X3* in Fig. 6 is used to pick up this signal current. Note that in this case all of the field current flows through the coil. This can be done because the field current is small. It is never more than 90 amp. whereas the load current that we just looked at may go above 4000 amp.

How It Works

Now let's see how the limit signals are weighed, packaged and fed to the *152* resistor. The reactor-rectifier setup that you see in Fig. 7 is used to do this.

The a.c. windings of the *X1* and the *X2* reactors are connected together and across a 55-volt, 400-cycle, a.c. power supply. These two reactor windings are exactly alike, hence the 55 volts would normally divide equally between them. However, current flow through the d.c. windings of the reactors upsets this division of voltage. This causes a shift of voltage from one reactor to the other. The amount of shift depends on which d.c. coils are carrying current and how much they are carrying. Current through the d.c. winding of the *X2* reactor causes part of the voltage to shift to the *X1* reactor. Current through the d.c. winding of the *X1* reactor causes part of the voltage to shift to the *X2* reactor. Now take a look at the rectifier *R3*. You can see that it is connected across the *X2* reactor so that it sees the *X2* voltage. It takes this voltage, changes it to d.c. and passes it along to the *152* resistor. You have already seen how *152* controls the exciter field.

By putting additional d.c. coils on the *X1* and *X2* re-

actors, you can feed in any other signals that you wish. When necessary this is done to take care of other requirements, such as dynamic braking control. The setup then becomes a sort of adding machine, only its adds electric signals instead of figures. You connect it up to an a.c. power source and feed in a number of signals. The answer appears on the outgoing leads from the *R3* rectifier. If you put a voltmeter across these leads you could read the answer in volts.

Suppose the generator load current goes too high. Let's see what happens. High current comes in on the d.c. winding of *X1*. This causes part of the a.c. voltage to shift to *X2*. High voltage on *X2* means high voltage on *R3* rectifier. It passes the high voltage on to the *152* resistor, but as d.c. instead of a.c. The high voltage across *152* chokes down the exciter field. This reduces the main generator field and thus its load current. The decrease in load current shows up on the *X1* d.c. winding that started the whole thing in the first place. And so it goes around and around until the load current is forced back into limits. By this scheme the generator actually controls its own load.

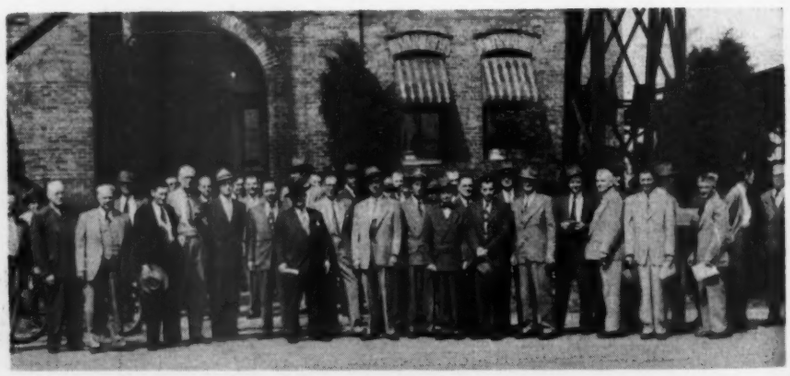
By increasing the current through the *X2* d.c. winding, Fig. 7, you can raise the current limit setting. That is what happens when the engineer notches out on the throttle. When the current in the *X2* d.c. winding increases, *X2* a.c. voltage shifts over to *X1*. Reducing the *X2* voltage reduces the *R3* output voltage and the *152* voltage. The reduced *152* voltage allows the exciter field to increase. When the load current gets up to the new setting, current through the *X1* d.c. winding will be high enough to shift the a.c. voltage back to *X2*. This then provides a means of adjusting the limit settings.

A second setup similar to this one takes care of the voltage limit. It uses reactors *X3* and *X4*, and a rectifier *R2* to do this. The *R2* rectifier output is also fed to the *152* resistor. Then the rectifier which puts out the higher voltage will control the exciter field.

The a.c. windings of the *X1*, *X2*, *X3* and *X4* reactors are shown on the schematic wiring diagram just as they are on the sketch in Fig. 7. However, the d.c. windings are not shown as they are on the sketch. Instead you find them drawn in the particular circuits where they are connected. This is to keep the diagram from becoming cluttered as it would if a number of windings were shown as they are in Fig. 7. However, on the wiring diagram the same symbols are used for the d.c. windings as in Fig. 7. You can easily tell which reactor the windings belong to because they are marked *X1*, *X2*, *X3* or *X4*. The letters *D1-D2*, *D3-D4*, etc., tell which way the current flows through the coil. Normally current would flow from *D1* to *D2*. In a bucking winding it flows from *D2* to *D1*. This is called the winding polarity. It is important to know polarity, particularly when you are connecting up a reactor. On locomotives with dynamic braking, the same reactors, rectifiers, and exciter are used for controlling the braking current. We'll see how this is done in a future article.

AIR CONDITIONING CLUB MEETS AT ROCKY MOUNT, N. C.

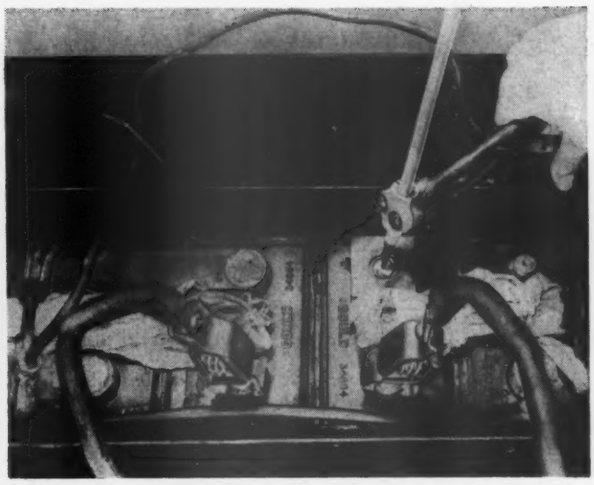
R. W. Tonning, Jr., acting shop superintendent, Atlantic Coast Line, Rocky Mount, N. C., and host to the Air Conditioning Club at the meeting on April 8, 1953, addresses the group before guides escorted the members through the shops on an inspection trip.



Upper right: The Air Conditioning Club in front of the general office building of the Atlantic Coast Line.

Lower right: Members of the club make a critical examination of air conditioning condensers cleaned by a sand blowing method demonstrated at the shops.

Proper technique in lead burning for battery repair involves using three cells of the battery (six volts) and a simple pointed carbon rod. Here a connector is being burned to a post. Fresh lead is being applied to the rod so that it flows down into the puddle, and damp rags are being used to protect adjacent parts.



When building up battery posts, the use of a mold is helpful, but care must be taken to prevent the carbon rod from touching the side of the mold. The jumper connection in the foreground replaces a missing connector so that six volts (three cells) is across the weld.

How to Use a Carbon Arc Burner in Battery Repair

LEAD burning (welding) is becoming increasingly important in lead battery maintenance. It may be done with an acetylene and oxygen torch or with a carbon burning outfit. The latter uses electrical power from the battery being repaired and involves but the simplest of equipment. The following instructions and precautions are volunteered by Gould-National Batteries as part of its current plus-performance plan.

The carbon burner consists only of an electrode holder and a carbon rod. It is designed for six volts (three cells of a battery) as its power supply. It is a common error to use the carbon burner on either fewer or more cells, the former being inadequate for making a good weld, the latter actually endangering battery, operator and joint. The burning tool may be connected either directly to the battery being worked upon or to three cells of an adjacent battery (if the unit under repair is entirely discharged).

The rod is pointed to a ⅛-in. tip and is permitted to extend from the holder to a length of about 1½ in. When possible, it should be connected to its power source so that the carbon rod is of negative polarity. This makes welding easier as it tends to keep the joint and the working surface clean. The lead surfaces to be welded must be clean. A wire brush may be used for this purpose after the surfaces have been neutralized. The inside hole of a connector may be cleaned with a knife. The tip of the carbon should be wire-brushed before starting. Dark glasses are recommended.

The secret of making a good joint is to have clean materials and a hot carbon. The technique calls for thoroughly heating the center of the part being worked until a puddle of molten metal exists. Only then may additional lead be added. The work must be done rapidly so that the operation is completed before the entire part melts. When possible, a damp rag is used to surround the part being worked on. When building up posts or splicing a connector, molds made for the purpose are used.

After making a burn, the joint must be allowed to cool undisturbed. In cooling, the lead will shrink slightly. If the joint is disturbed during cooling, the lead may crystallize and result in a poor joint.

When working within a mold, it is necessary that the carbon not be permitted to touch the side of the mold.

To determine whether a weld has been properly made, it is wise to test with a pair of pliers (after the joint has cooled) to see if the joint will strongly resist separation. If separation occurs, the two surfaces must be examined to determine the points and nature of weakness so that the situation can be corrected on the second try.

When new lead is added to a joint, the new lead must be touched to the carbon rod so it flows down into the puddle. Cold lead must not be plunged into the puddle itself.

In burning a connector to a post, one slow trip around the post should be sufficient to make a satisfactory weld. Although the same is true of burning a post to the lead-insert of a new cover, the depth of the joint is such that considerable lead will have been removed from the post in a single slow circuit around the joint. Therefore, the carbon point should be returned to the center of the post and new lead added to raise the post height up to the level of the top of the post mold.

Questions and Answers

Diesel-Electric Locomotives*

CIRCUIT ANALYSIS (*Continued*)

775-Q.—Under which condition does this action take place?
A.—If engine water temperature is not rising too fast, the pressure exerted by the bellows piston will not be sufficient to hold *TC* and *C* in contact and the bi-metal strip will push them apart, opening the motor circuit.

776-Q.—With the motor circuit open what transpires?
A.—Rheostat operation is stopped.

777-Q.—How is the clutch affected at this time?
A.—Enough resistance has been removed from the clutch circuit to allow some current to reach the clutch field and the resulting magnetism causes the two halves to be attracted to each other. However the attraction is weak and slippage between the halves will be great.

778-Q.—What is the result of greater slippage between the two halves?
A.—This results in slow fan speed.

779-Q.—What happens in the event that the slow fan speed cannot hold water temperature in the 155 deg. range?
A.—In this event the bellows will again force *TC* against *C* as increasing water temperature causes increased pressure within the bellows.

780-Q.—What results from this contact?
A.—The motor will remove more resistance from the clutch field by again turning the rheostat.

781-Q.—How do we prevent too much fan speed?
A.—*H2* works as before to prevent too much fan speed by preventing too much resistance from being removed.

782-Q.—Suppose that the increased fan speed holds engine water temperature at its proper level for a time, and then the water temperature begins to drop slightly?
A.—As temperature drops, the fluid in the bulb-bellows apparatus contracts to allow *TC* to drop back against contact *J* as shown in Fig. 4.

783-Q.—What is the resulting current flow?
A.—Current now flows through *J* to heating element *H1*, motor field *G* and the motor armature.

784-Q.—What has taken place with respect to motor field *R*?
A.—Motor field *R* is not being used. Motor field *G* is now used instead.

785-Q.—What is the difference in the action of these two motor fields?
A. Motor field *R* causes the motor to take resistance OUT of the clutch field and motor field *G* causes the motor to turn in the other direction.

786-Q.—What results from this reverse action of the motor?
A.—The rheostat arm is moved to add resistance and weaken the current in the clutch field.

787-Q.—What is the result of this action?
A.—Less magnetism is produced, the attraction between the coupling halves weakens and slippage increases to slow the cooling fan.

788-Q.—How does the heating element *H1* function?
A.—This heating element acts to force a second bi-metal strip against *TC*.

789-Q.—What will be the result?
A.—This will separate *TC* and *J* before the motor runs in enough resistance to completely stop the fan.

790-Q.—What happens if operating conditions cause a drop in temperature below 155 deg.?
A.—The fluid in the bellows then contracts.

791-Q.—What contacts are then affected?
A.—*TC* will then move against *J* as the fluid in the bellows contracts.

792-Q.—What takes place with the meeting of these two contacts?
A.—The motor turns the rheostat again to add resistance.

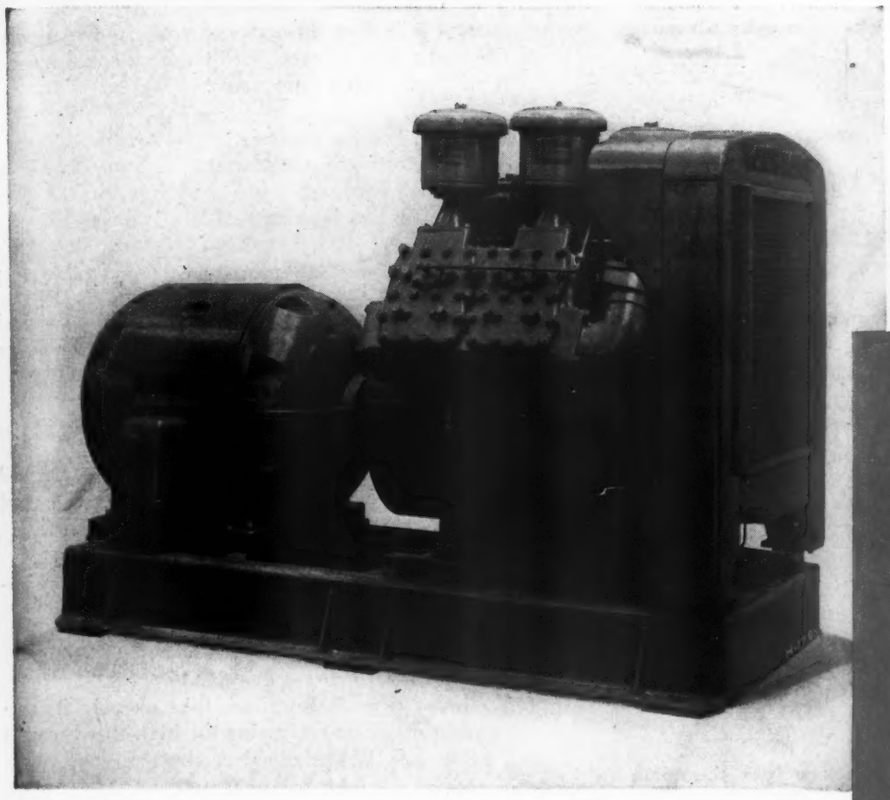
793-Q.—What happens as the rheostat reaches maximum resistance position?
A.—The cams close *I2* to energize *SMV* and close the shutters. They also open *I1* to prevent any further motor rotation.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives. The figure numbers and references, by number, to diagrams, etc., relate to the current edition of the Alco-G.E. operating and maintenance manual.

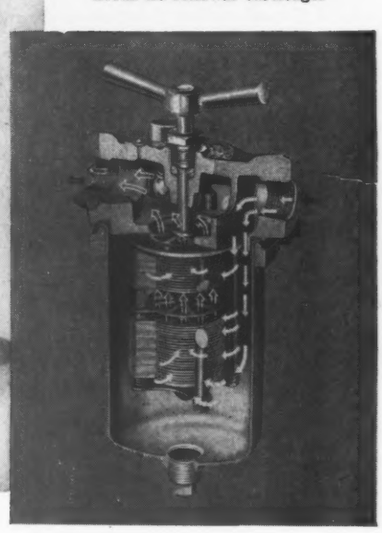
Schedule 24 RL Air Brakes

SPEED-GOVERNOR CONTROL (*Continued*)

1540-Q.—What results from this increase in resistance?
A.—This increase in resistance in series with the relay reduces the current through the relay to such an extent that a slight reduction in the speed of the vehicle will cause relay *2L* to assume the de-energized position.



CUNO AUTO-KLEAN FILTER (below) part of force-feed lubrication system that saves 25-50% on lubrication costs of Worthington Radial Compressor (left). No mere screen for this filtering job, but a special unit that removes small as well as big particles. Filter is cleaned by a single turn of the handle; needs no renewal cartridge.



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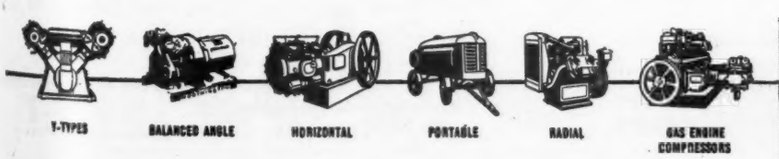

No Other Compressor Will Outperform a Worthington

WORTHINGTON

Compressors

1541-Q.—What current flow results when relay *6* assumes the de-energized position?

A.—A voltage is induced momentarily in the upper coil of this relay which causes current to flow to the lower coil of relay *2L*.

1542-Q.—What does the current flow insure?

A.—This current flow adds sufficient additional force to relay *2L* to insure the positive closing of its contact.

1543-Q.—Describe the action when vehicle speed exceeds approximately 43 m.p.h.?

A.—When the speed exceeds 43 m.p.h. there is sufficient current flow through relay *2M* to cause it to assume the energized position thus closing its contact *B2-B3*.

1544-Q.—What is the result when this contact is closed?

A.—The closing of this contact causes battery current to flow from terminal *45* through contact *B2-B3* of relay *2M*, resistor *10*, lower coil of relay *6M*, and terminal *38* to the negative side of the battery.

1545-Q.—How is relay *6M* affected at this time?

A.—Relay *6M* becomes energized.

1546-Q.—What does the induced voltage from the upper coil of relay *6M* accomplish?

A.—This voltage acts on relay *2M* to insure positive closing of its contacts as explained for relays *6* and *2L*.

1547-Q.—Explain the current flow through relay *6M* at this time.

A.—Battery current now flows through contact *A6-A5* of this relay and terminal *40* to energize the medium speed magnet *M* of the F.S.1864 relay valve.

1548-Q.—What braking pressure is now developed?

A.—80 percent maximum braking pressure.

1549-Q.—What position does relay *6M* assume if the speed is reduced to approximately 40 m.p.h.?

A.—Contact *B1-B2* of relay *6M* is open, which increases the amount of resistance in series with relay *2M*, thus insuring that this relay will assume the de-energized position if the speed is reduced to approximately 40 m.p.h.

1550-Q.—What takes place when speed exceeds approximately 69 m.p.h.?

A.—There is sufficient voltage developed in the generator to cause relay *2H* to assume the energized position.

1551-Q.—What action results from the relay being energized?

A.—The closing of its contact *B2-B3* completes the circuit from resistor *9* through the lower coil of relay *6* and contact *B2-B3* of relay *2H* to the negative side of the battery. Thus relay *6* again assumes the energized position.

1552-Q.—Describe the resulting current flow.

A.—Contact *C4-C3* of relay *6* being closed, battery current will flow through contacts *A6-A5* of relay *6M* and *C4-C3* of relay *6* to the high speed magnet *H* of the F.S.1864 relay valve.

1553-Q.—What braking pressure is now developed?

A.—With both the medium and high speed magnets of the F.S.1864 relay valve thus energized, 100 percent maxium braking pressure is developed.

1554-Q.—In what way has transfer contact *C4-C5-C6* of relay *6M* now functioned?

A.—It has now functioned to insure that the induced voltage from relay *6* will now act on *2H* relay rather than on relay *2L* as occurred at the lower speed.

1555-Q.—What takes place when a brake application reduces the speed below 65 m.p.h?

A.—The reduced current flowing through the coil of relay *2H* causes it to assume the de-energized position.

1556-Q.—What results when relay *2H* assumes the de-energized position?

A.—Its contact *B2-B3* is opened.

1557-Q.—With this contact open, what happens?

A.—Relay *6* is de-energized, thus opening its contact *C4-C3* and de-energizing the high speed magnet *H* of the F.S.1864 relay valve.

1558-Q.—What braking pressure is now developed?

A.—80 percent maxium braking pressure is developed as only the medium speed magnet *M* is energized.

1559-Q.—What takes place when the speed reduces to approximately 40 m.p.h.?

A.—Relay *2M* becomes de-energized, its contact *B2-B3* opening the circuit of relay *6M*.

1560-Q.—What then happens?

A.—This relay in turn becomes de-energized and the opening of its contact *A6-A5* de-energized the medium speed magnet *M*.

1561-Q.—What braking pressure is now developed?

A.—60 percent maxium braking pressure.

1562-Q.—What happens at a speed of approximately 20 m.p.h.?

A.—Relay *2L* drops out, thus opening its contact *B2-B3*.

1563-Q.—What results when this contact is opened?

A.—The opening of this contact removes the short circuit around relay *6*, allowing it to be energized.

1564-Q.—What then happens?

A.—Closing of contact *A4-A3* of relay *6* energized the low speed magnet *L* of the relay valve thus developing 40 percent maxium braking pressure.

1565-Q.—In the event of an open wire from the generator or battery what is the action?

A.—The F.S.1864 relay magnet is de-energized.

1566-Q.—What maximum braking pressure is then developed?

A.—60 percent maxium braking pressure.

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NEW DEVICES

Kanigen Plating Process Produces Non-Porous Nickel Coat

An entirely new process of nickel plating which greatly stretches the available nickel supply and which "may well prove to be one of the most far-reaching industrial developments since World War II," has been announced by the General American Transportation Corporation. The process, which requires no electrolytic equipment, has been named "Kanigen."

General American, which owns and operates a large fleet of tank cars, originally set out to develop a process for the interior coating of cars designed to carry corrosive chemicals and materials which must not be contaminated by "pick-up iron" from the tank-car metal. Up to this time it has been necessary to finish certain tank-car interiors with several coats of bake-on enamel, a process which is expensive, time-consuming, and lasts only three to five years. It was believed that nickel plating would prove the ultimate solution, but the continuous electroplating of so large a surface as the interior of a tank car is very difficult under present limitations of the electroplating process.

General American's research group succeeded in developing the Kanigen process through the reduction of nickel by the use of hypophosphites, a principle upon which the National Bureau of Standards had done considerable work several years earlier. After the process was perfected in the laboratory, a plot plant was built in East Chicago, Ind., in the summer of 1952 and has been in constant service since. Because the throwing power of this process is 100 per cent, it has been found practical for pieces of any shape or size and will prove eminently satisfactory for its intended purpose—the interior coating of tank cars.

Kanigen plate is a nickel-nickel-phosphide composition. Normal Kanigen platings run about 5 to 8 per cent phosphorus and have a Vickers hardness of 550-650 (600 Vickers-535 Brinell). Its ductility is very low and it is not recommended for parts which will be subjected to considerable flexing, such as springs. Its minimum thickness is within 10 per cent of average thickness, while electrolytic nickel can run from 25 to 200 per cent in variations between minimum and maximum. In typical applications, even on a large scale, Kanigen is not likely to show any pores even at plating thicknesses of a half thousandth of an inch. Its adhesion is excellent. Plated steel test specimens pulled to failure in a tensile machine show no flaking or chipping of the plating. Its coefficient of expansion is .000013 per deg. C. Electrical resistivity is approximately 60 microhms per cm.

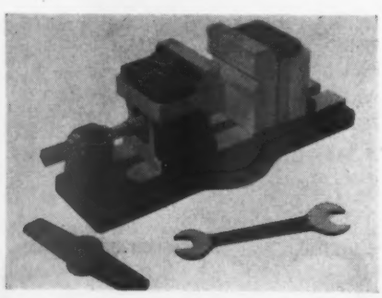
The process, which operates at temperatures just under 212 deg. F., it is said, will plate any article uniformly regardless of size or shape. Parts subject to hard wear and abrasion may be continuously coated and hardened far beyond the capacity of the parent metal; over-machined parts may be brought back to proper tolerances; parts formerly machined of Monel metal and other corrosion resisting materials can now be cast steel and plated to a thickness of three mils with a consequent saving of expense and critical material. It has proved satisfactory for production-line nickel-plating of steel, copper, brass, bronze, stainless steel and aluminum. Tests on plastics and magnesium indicate that these materials will prove practical for Kanigen plating.

The comparative cost of Kanigen plating, depending upon the object, can vary from close to "break even" to a very decided saving. Kanigen requires less nickel to do a given job, though material cost per pound of deposited nickel from a chemical bath is substantially greater than for one pound of nickel deposited electrolytically. For thin coatings Kanigen is much more economical than electroplate. This advantage decreases with thickness, though thick coats are rarely required with Kanigen.

General American will build two new plants, one at East Chicago and the other at Los Angeles, to utilize the new process. These are expected to be in operation by this third quarter of 1953. Thereafter, other firms will be licensed to use the process since its applications appear to be so wide that no one organization can meet all requirements.

The next step will be the design of a special unit large enough to accommodate tank-car tanks and large vessels as soon as a nickel supply is assured for that purpose.

■ ■ ■



Four-In-One Vise

Reduction of set-up time and elimination of jigs are claimed by the manufacturer when using this unit, known as the Utility Vise. The device saves time of adjusting clamps, bolts, washers, parallel strips, etc., used in rigging work on drill presses, millers, grinders, shapers and other machine tools.

Devised by the Brown Engineering Company, Reading 2, Pa., its rear turret revolves, presenting four different faces for holding round, square, actagonal, rectangular and other shaped work either vertically, horizontally or at an angle. Auxiliary jaws at the top of each turret can be spread at an angle to hold odd-shaped work.

■

Pressure-Sensitive, Heat Curing Tape

A new type of electrical tape designed for wrapping motor and generator coils, transformer windings, etc., has been announced by Industrial Tape Corporation, New Brunswick, N. J.

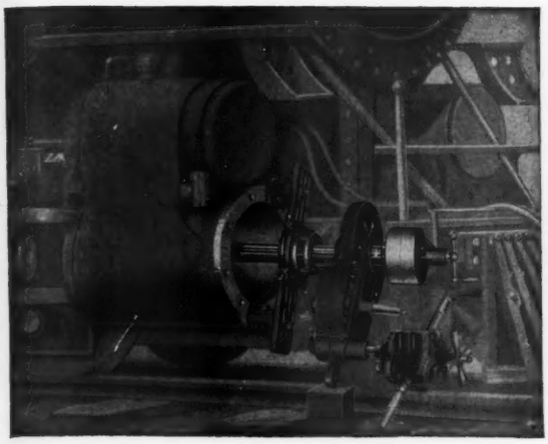
The tape, to be known as Permacel Two-in-One, sticks at a touch and heat-cures into a permanent bond. The maker states that it will not soften up or come loose, slip or slide, either during varnish baking or in the end use of the product and that it has excellent all-round electrical properties. It cures in 1 hr., at 300 deg. F. and in 2 hr. at 250 deg. F. It is available in paper, cloth, film or acetate fiber backings.

Heavy Duty Pneumatic Drill

Constructed for heavy-duty operations, this unit is light in weight and compact. Designated as Model PD-304 P pneumatic drill, it is manufactured by the Mall Tool Company, Chicago 19.

The drill is equipped with a contoured pistol grip, trigger throttle and a built-in speed regulator. It has its own built-in

(*Continued on page 92*)



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The Steam Locomotive

By RALPH P. JOHNSON

Chief Engineer, The Baldwin Locomotive Works

An authoritative treatise on the theory, operation and economics of the steam locomotive which includes comparisons with Diesel-electric locomotives. The subject matter is stripped down to fundamentals. Enough background is included to indicate paths of development.

1944. 2nd. 564 pages, 90 illus., 75 tables, 6x9, $6.50

★

4-6-4 Locomotive and Tender Chart

Shows 315 numbered parts including all the latest equipment on a Hudson type passenger locomotive. Scaled elevation and four cross-sectional drawings.

40x30 inches, folded to 9½x12, $1.00

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oiler and all moving parts glide on ball bearings.

This device measures 6 13/32 in. in length, 2 1/16 in. in width, 6 1/2 in. in height and weighs 3 lb. It is furnished with a 1/4 in. Jacobs chuck, key, wrench, hydraulic fitting, a 1/4 in. air hose and lubricant.

■

Vertical Chucking Grinding Machine

To meet requirements for grinding larger sizes of work, The Ballard Company, Bridgeport 2, Conn., has introduced a vertical chucking grinder in six sizes of 30, 36, 42, 54, 64 and 74 in. Use of mechanical, hydraulic and electrical components provides accuracy and ease of operation.

A variable speed drive provides table speeds from creeping to high. Reversing controls permit the grinding spindles to be run in either direction. Grinding spindle speeds, furnished to requirements, have maximum motor rating of 10 hp. for main spindles and 5 hp. for side head spindles. The grinding heads are equipped with hydraulic drive for smooth reciprocating action.

A fine feed and adjustable dwell are provided for grinding up to shoulders in combination with any of twelve available reciprocating speeds. Dual control desks with push-button controls provide ease of machine operation from either side. These desks are interlocked so that only one is operable at any time.

The grinding wheels are mounted on the motor armature shaft. The grinding spindle housing incorporates the motor field. Hardened and ground square lock ways for both heads are concealed and protected

within the head housing. (The cylindrical grinding wheel housing or motor frame does not constitute a reciprocating bearing member.) Grinding spindles can be readily removed from the square lock slide within the head, permitting a spare to be quickly installed.

Non-metallic surfaces bear against the hardened way and adjustable taper gibs are provided for maximum uniform rigidity. Grinding slides within the head are always in full bearing. Overhang is constant for all grinding strokes. All exposed bearings are protected by scrapers and grit shields. Infinitely variable reciprocating speed, hydraulically operated, wheel dressers are built into each head. The construction is such that the wheels can be properly dressed to specific requirements without upsetting the grinding cycle. Wheel dressers are equipped with their own independent reciprocating ways and therefore can be adjusted to obtain the optimum dressing conditions.

Automatic lubrication systems are provided on the main and side heads. Electrical interlocks have been furnished so that the grinder cannot be started unless the work is properly held by the magnetic chuck.

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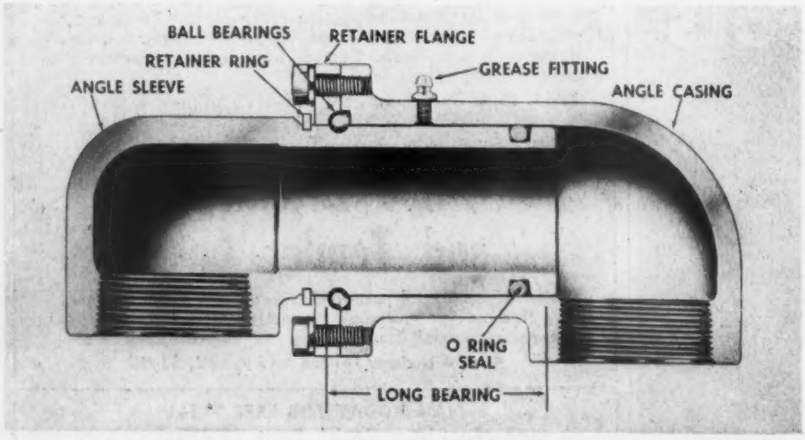

Ball Bearing Swing Joints

These devices can be utilized on loading and unloading lines handling oils, gasoline, water, gas and other liquids. Offered in steel for railroad service, they are produced in eleven styles including counter-balance and double swing and in four sizes of 2, 2 1/2, 3 and 4 in.

Announced by Barco Manufacturing Co., Chicago 40, the units are ball bearing equipped to provide support for piping. Special "O" rings are provided for handling liquids without softening, swelling or deterioration at temperatures from minus 30 deg. F. to plus 250 deg. F. They are claimed to be suitable for pressures up to 1,500 psi. hydraulic, depending on size and service.

Sand Drying System

A feature of this system is a drying tower where sand is dried after passing through an elaborate washing and classifying process. This component, known as a vertical sand dryer, has been made without moving parts.

Manufactured by the Hydro-Blast Corporation, Chicago, Ill., the system will reclaim up to 5 tons of sand per hour. As the sand is washed from the foundry castings, it flows into a large, slowly revolving cylindrical screen. This screen breaks up any sand lumps which have formed, and its meshing removes any foreign bodies which may have collected, such as gaggers and lumps of coke.

The sand is then combined with water and pumped as a slurry into a six unit classifier which removes the silt. Coming out of the classifier, it drops into a storage bin, from which it is passed through a cylinder for removal of excessive water.

Here, the sand is elevated to the top of the drying tower. It falls naturally through this tower, passing slowly through a series of hot air ducts, built in rows through the complete height of the tower.

A variable speed screw conveyor at the

(Continued on page 94)

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bottom of the dryer next transfers the sand into a bucket conveyor which raises it to a second conveyor belt traveling over a magnetic pulley. The belt transfers the sand to a storage bin above the sand mixer while removing remaining metallic particles.

Deposited in the storage bin, the sand is ready to be metered out for additional use as needs require. The entire system works on automatic controls. Power is supplied by 13 different electric motors, ranging from 1 to 15 hp.

The system reduces foundry dust and frees valuable plant floor and storage space for other purposes.

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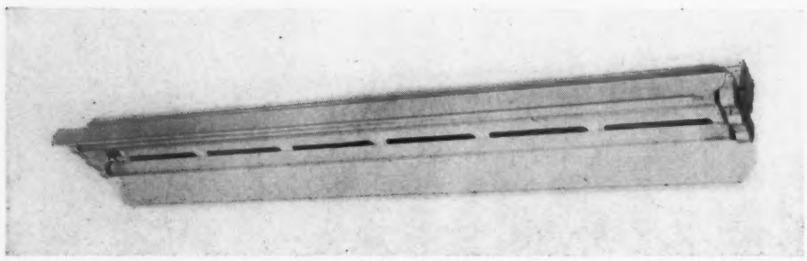

Upward Component Luminaire

An industrial luminaire, type SDP, which provides more comfortable seeing conditions by means of an upward component is now available from the Westinghouse Electric Corporation, Pittsburgh 30. It uses two slimline lamps of 38, 58, or 75 watts each.

The upward component, which distributes 23 per cent of the light towards the ceiling, eliminates the severe contrast between bright luminaires and dark ceiling.

Styled for heavy industrial use, the luminaire provides the upward components by slots located over the lamps on each side of the reflector. The all-white hood is heavily ribbed and consequently has lost none of its strength due to the introduction of the slots. The porcelain enamel reflecting surface is one piece and is easily removable for cleaning. It uses the new lead-lag slimline ballast.

Back-to-back lamp spacing is provided, and adjustable slide action hangers are available. Also available is a longitudinal shield to provide 27-deg. shielding.

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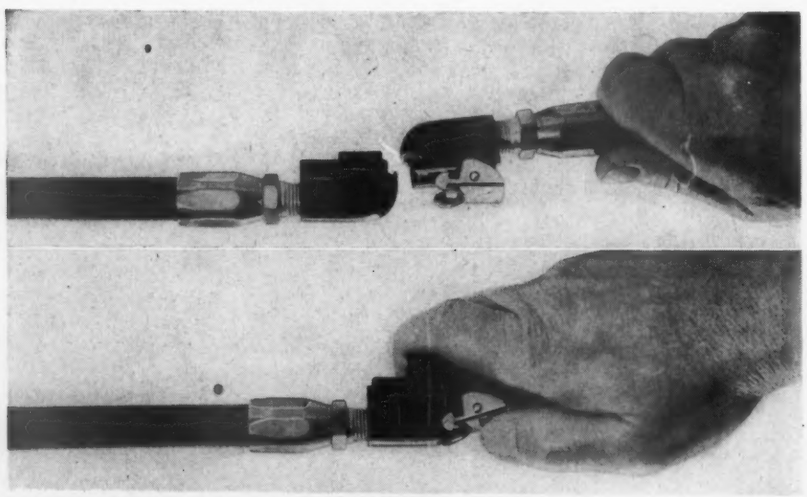

The simplicity of the Slide Seal coupling is shown in these two views.

Slide Seal Coupling

These couplings may be used with a range of fluids such as hydraulics, water, oil, crude and fuel oils, anti-freeze solutions, gasoline, diesel fuels and others. Applications may include use on engine test stands, drilling rigs, etc.

Developed by Aeroquip Corporation, Jackson, Mich., the device permits instant connection and disconnection of fluid-carrying lines by means of push-pull action. It consists of two 2-piece aluminum assemblies with rubber 'O' rings. A spring actuated locking device holds each half of the coupling together and permits full flow of fluids.

Pressure on the lock lever separates the coupling halves and it is disconnected by a light pull. Reconnection may be accomplished without actuating the lock lever.

Hydraulic Press Touch Control Valve

This manually operated touch control valve gives "power steering" for hydraulic press operation. The slightest movement of this control is converted directly into ram movement. The ram starts, stops, reverses, speeds up, slows down or exerts pressure in exact relation to every move of the hand lever. The device has been made available by the Denison Engineering Co., Columbus 16, Ohio.

Pressures are quickly shown on the dial gage of the hydraulic Multipress unit, also designed by Denison. The operator can build up pressures quickly or slowly, to any predetermined need.

One of the operations for the hydraulic press equipped with this valve is straightening. The operator is able to apply pressure, up to 50 tons, just a little at a time or all at once.

■

Corn Cob Meal Hand Cleaner

This formulation is a light weight powder containing corn cob meal as the abrasive. Announced by the Magnus Chemical Company, Garwood, N. J., it is said to be ideal for use by those desiring a soft, mild abrasive.

The product contains Lanolin and has a mild alkalinity of 7.5 pH. It will not rot, ferment, attract vermin or clog drains and is sold in bulk only, in 90 and 185 lb. drums.

■

High-Capacity Storage Batteries

Twenty per cent more capacity in the same space is claimed for the new line of T-H (Thrifty Hauler) Exide Ironclad batteries just announced by the Electric Storage Battery Company, Philadelphia, Pa.

The battery incorporates new materials and structural changes to give increased capacity. In many materials handling and haulage jobs, this increased capacity is needed to work through a full shift.

Polyethylene non-oxidizing slotted plastic tubes are used to keep the active material in constant contact with the grid spines and still permit free electrolyte penetration throughout the active material. An added feature is a polyethylene acid-proof tube-sealer to the bottom of the positive plate, which seals in the active material and maintains battery capacity for a longer working life. Grids contain corrosion-resistant Silvium, which the manufacturer states also contributes toward longer battery life.

Positive plates in this T-H battery are larger, and are balanced by extra heavy negative plates. Pormax separators, a new homogenized sealing compound, and seamless rubber jars are other features.

Steel trays are sprayed with a plastic

coating which is acid-resistant and possesses good insulationg qualities. Quarter-turn unbreakable plastic vent plugs facilitate quick and easy flushing.

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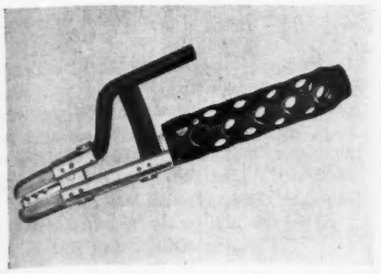

Insulated Electrode Holder

An insulated electrode holder of 400 amp. capacity has been announced by The Lincoln Electric Company, Cleveland 17. Designated the model Cooltong, it will handle electrodes from ⅛ to 5/16 in. in size and it has a wide opening to permit fast release of studs.

Its nose is sandwiched, consisting of a copper core between four and six layers of glass impregnated plastic cloth. The jaws, also covered by this insulation, are made of non-spatter type metal.

Current carrying frame parts are made of pure copper. These parts are reinforced with steel for rigidity. The holder handle is perforated with large holes to permit ventilation and reduce heating from induced currents when welding with alternating current. This handle is unbreakable.

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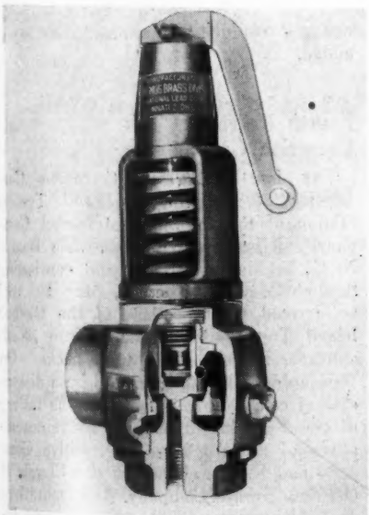
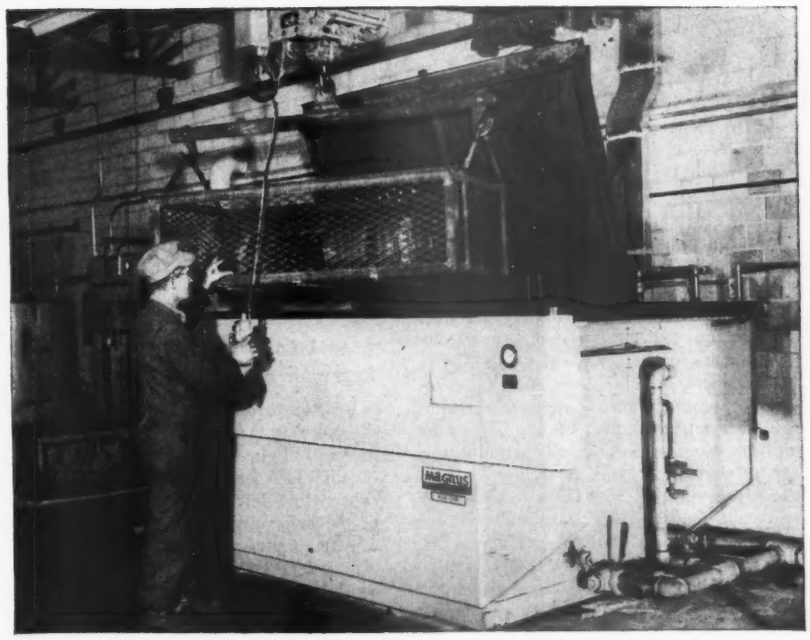


Steam Safety Valve

A new device, the Fig. 391 Safety Valve has been made available. This unit incorporates an open spring case and leak-proof bellows above the feather valve.

Designed for use on diesel locomotive steam generators, the unit is said to offer ease of adjustment of blow down control, a top and bottom guided feather valve and

(*Continued on page 118*)



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As more than 60 railroads have already discovered, you will find that the Magnus Method will enable you to quickly and thoroughly clean disassembled engine parts *at lowest unit cost!* Here is why:

1. 95% of all hand labor is eliminated.
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NEWS

"Laboratory" Reefer for CNR

MARINE INDUSTRIES, LTD., of Sorel, Que., has built an experimental refrigerator car designed by Canadian National research engineers. The car, now undergoing test, features an underframe that, except for drawbar mechanisms and safety devices, is made entirely of aluminum, and a double purpose superstructure which will provide cold-wall refrigeration and help maintain uniform temperatures in all parts of the car by circulating a liquid coolant through the superstructure. The car also will have adjustable bulkheads between end bunkers and the main part of the car. Floor, walls and roof will be formed by insulated plywood panels bolted to the superstructure.

The superstructure, consisting largely of monel metal pipes, not only will support the main body of the car, but also will form a circulating system for the liquid coolant, either brine, ammonium nitrate solution or some other type. It is expected this method will decrease temperature differentials between lower and upper parts of the car. The liquid itself is to be cooled in end bunkers containing a mixture of salt and ice.

In winter the same liquid will be used to warm the car. The liquid will be heated in a charcoal burner beneath the car and forced through the circulatory system in the walls to provide warm-wall heating. It will be possible to move bulkheads from their normal positions to the ends of the car to provide extra space for lading.

Report on Explosion of Air Reservoir on Diesel-Electric

REPORTING on its investigation of an explosion of a main air reservoir on a diesel locomotive, the Interstate Commerce Commission has found that the accident was caused by "defective brazing" at the head of the reservoir, and "accumulation of excessive air pressure resulting from improper piping arrangement and an inoperative air-compressor safety valve."

The report, No. 3493, was by Commissioner Patterson. It was dated January 5, and the investigation out of which it came was conducted by the Commission's Bureau of Locomotive Inspection.

A Southern locomotive was involved, the accident having occurred October 3, 1952, on a wash rack track at that road's Finley shop in Birmingham, Ala. "Two pipefitters were seriously injured," the commission reported.

On the matter of the brazing, the report said in part: "Examination of the ruptured portion disclosed that approximately 75 per cent of the head flange was improperly fitted, excess bronze metal had flowed between the flange and the shell, indicating ineffectual bonding. The weld around the entire circumference of the head was found to be from only a trace to ⅛ in. thick and close examination of the edge of the sheet disclosed approximately 80 per cent of the braze on the head seam was ineffective."

As to the piping, the report had this to say: "The piping arrangement . . . did not correspond with the recommendation for this equipment inasmuch as closure of the 1-in. main-reservoir cutout cock installed in the discharge line from No. 1 reservoir and which was provided with a ¼-in. side drain depleted No. 2 reservoir pressure, thereby nullifying air-compressor governor, unloader, and the 2-in. safety-valve protection. The conventional piping arrangement for the No. 8-EL brake equipment calls for the 1-in. main-reservoir cutout valve to be located in the final discharge pipe from No. 2 main reservoir in such location that it will not nullify operation of the air-compressor unloading facilities and the 2-in. safety valve. Investigation failed to develop whether or not the main reservoir piping arrangement . . .. was as originally installed on the unit or had been changed at some shop repair period."

The report also said that the reservoir which exploded and the other main reservoir on the locomotive involved had been in service since 1940, and had previously been on another locomotive. "No record of where or when the reservoirs were changed could be obtained," the report added.

This Alco-G. E. diesel-electric locomotive, one of 83 units which can operate on standard, 60-in., 63-in. or 66-in. track gages and in arctic cold or tropic heat, was delivered to the Army Transportation Corps at the Schenectady plant of the American Locomotive Company on April 3. Present to inspect and accept the locomotive were Brig. Gen. Paul F. Yount, acting chief of transportation, and officers representing the Supply and Field Service and Railway Transportation Service Divisions.

Fourth Railroad Corrosion Conference

THE fourth Railroad Corrosion Conference at the Harbor Island Testing Station of the International Nickel Company will be held at Wrightsville Beach, N. C., beginning May 19, and continuing through May 21. Tuesday, May 19, will be devoted to inspections of the Harbor Island Test Station and the Kure Beach atmospheric exposure test racks. On Wednesday, May 20, there will be a discussion of corrosion as a factor in the failure of diesel crankshaft bearings by representatives of the American Locomotive Company and R. A. Schaefer of the Cleveland Graphite Bronze Company. Representatives of the railroads and oil companies are invited to participate in this discussion.

F. L. LaQue of International Nickel will discuss means proposed for controlling scaling and corrosion in boilers on Wednesday morning, May 20. In the afternoon L. W. Doggett, mechanical engineer, Virginian; V. Barth, Chicago & North Western, and T. Fredericks, New York Central System, will compare service experiences of their railroads between the high-strength low-alloy, copper-bearing and plain carbon steels. Timber deterioration

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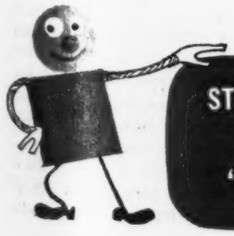
- **90 MILES PER HOUR!...**
- **SEVERE VIBRATION AND SHOCK!...**
- **NO LUBRICATION!...**

That's the everyday set of rules for main-generator brush operation. Satisfactory service under these conditions is made possible by a very significant, microscopic *film* on the commutator surface. When this film is *right,* it protects the commutator against excessive wear, sparking, dragging, burning — and adds long life to the brush. When it's *wrong* — you've seen the bills for commutator maintenance!

One big reason why more "National" main-generator brushes are used than all other makes combined is their ability to lay down and maintain a commutator film that results in trouble-free service and less frequent commutator maintenance.

For years, NATIONAL CARBON engineers have been studying the phenomena which determine film formation. Even now, these continuing studies are paving the way for still greater maintenance economies in the future.



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and preservation of wood as viewed from a railroad engineer's standpoint will be discussed by A. P. Richards, director, Wm. F. Clapp Laboratories, Inc. C. L. Crockett, chief chemist, Norfolk & Western, will bring up-to-date the data presented at the 1952 meeting on hopper-car interior protective coating compounds.

On Thursday morning, May 21, Dr. John Ryznor, National Aluminate Corporation, and J. W. Wilks, Dearborn Chemical Company, will explain the reason for the use of inhibitors not containing chromates in railway diesel cooling systems, their effectiveness as developed by extensive laboratory and field testing, and the methods used to check dosages as well as their effect on lubricating oils. This discussion will be followed by a review of experiences with "TRC" and other manganese modified stainless steels by E. E. Chapman, mechanical assistant, Atchison, Topeka & Santa Fe; G. A. Lux Oakite Products, Inc., and Charles B. Allen, chief metallurgist (Red Lion Plant) Budd Company.

SUMMARY OF MONTHLY HOT BOX REPORTS

	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	....	....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,809,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952	2,766,313,714	3,826	7,759	11,585	238,784
May, 1952	2,918,508,445	6,020	10,938	16,958	172,102
June, 1952	2,672,512,889	8,466	14,495	22,961	116,394
July, 1952	2,575,298,912	10,566	15,833	26,399	97,553
August, 1952	2,924,917,122	11,658	17,535	29,193	100,192
September, 1952	2,931,129,734	7,536	13,608	21,144	138,627
October, 1952	3,093,990,289	4,058	8,053	12,111	255,469
November, 1952	2,984,101,808	2,198	4,501	6,699	445,455
December, 1952	2,869,928,617	1,742	3,632	5,374	534,040
January, 1953	2,828,906,282	2,219	4,123	6,342	446,059

CV Runs Diesel School for Shop Men

A DIESEL school for its shop machines has been established by the Central Vermont at its St. Albans, Vt., shops. Already, some of the road's manifest trains are operated by diesels and the shop men are being prepared for the time when diesel operation will bcome more general.

The objective of the school is to train machinists, electricians, pipe fitters, sheet-metal workers, boilermakers and blacksmiths who have spent the greater part of their working life dealing with steam locomotives in the road's shops so that they can take over the maintenance of diesel locomotives as they replace steam. The course is divided into three parts, designated as the "freshman," "junior" and "senior" classes, each running for a period of 11 weeks, the entire course thus requiring 33 weeks for completion. So that each man may obtain a satisfactory amount of individual instruction classes are limited to 15 men each.

Classes are held during regular working hours in the Central Vermont Recreation Association rooms on each Tuesday. Instruction includes lectures, visual instruction through motion pictures and slides, and practical demonstrations. Home study is assigned after each class. So far, the shop men are said to be having little difficulty in acquiring an understanding of diesel locomotive details.

The first class is scheduled to complete its "freshman" course on April 21. The second class will begin its instruction on April 28 and run through to July 7. The third class will begin its work on July 14 and finish its "freshman" course on September 22. Other classes will be organized later for employees who have not already received their class assignments.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE APRIL ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of Units	Horse-Power	Service	Builder
Central of Georgia	1[1]	1,500	Road switch	Electro-Motive
Chicago, Burlington & Quincy	8[2]	2,250	Passenger	Electro-Motive
	25[2]	1,500	Road switch	Electro-Motive
Illinoid Central	35[3]	1,500	Road switch	Electro-Motive
	2[3]	2,250	Passenger	Electro-Motive
Mississippi Central	10[4]	1,200	Switch	Electro-Motive
Southern Pacific	12[5]	2,250	Passenger	
	87[5]	1,500	Freight	Alco-G. E.
	19[5]	1,600	Freight	Electro-Motive
	3[5]	1,200	Freight	Fairbanks, Morse
	10[5]	800	Freight	Baldwin-Lima-Hamilton
	19[5]	1,200	Switch	
Union Pacific	10[6]	1,500	Road switch	Electro-Motive

Road	No. of cars	Type of car	Builder
Central of Georgia	1,000[7]	50-ton box	Pullman-Standard
Pacific Fruit Express	200[8]	70-ton refrigerator	Company shops
Savannah & Atlanta	200[9]		Pullman-Standard
Southern	500[10]	70-ton gondola	American Car & Fdry.
Warren Petroleum Corp.	500[11]	Tank	American Car & Fdry.

[1] Cost, $182,400. For delivery this month.
[2] Delivery expected during third quarter of this year.
[3] Road switchers delivered; delivery of passenger units expected this month.
[4] Cost, $106,042 each. Delivery expected this month.
[5] Authorization for the purchase of this equipment was announced in the April issue, page 116.
[6] Total cost approximately $2,000,000. Delivery scheduled for June.
[7] Part of 3,000 to be purchased over a three-year period (see page 124, March issue.) Delivery scheduled for next fall.
[8] Estimated cost, $3,330,000. Authorization to acquire these cars was reported in the March issue, page 124. Half the cars, to be equipped with conventional end ice bunkers, will have inside length, width and heighth of, respectively, 43½ ft., 8½ ft. and 8½ ft. Their maximum loading height will be 6 ft. 7½ in. Delivery of these units is anticipated later this year. The other 100 cars, of an as yet undetermined design, will be mechanically refrigerated, with these inside dimensions: Length, 44½ ft., width, 8½ ft. Maximum loading height will be 7 ft. 3 in. Delivery is expected in the last quarter of 1953, or early in 1954.
[9] Estimated cost, $1,200,000. Authorization to purchase this equipment, part of a three-year program to purchase 600 cars, was reported in the March issue, page 124.
[10] Delivery expected to begin during the third quarter of this year.
[11] Half the cars will be 11,000-gal. dual service high pressure units for carrying liquefied petroleum gas, and the remainder, of 8,000-gal. capacity each, will be for transporting gasoline.

Railroad Maintenance Study

DEFERRED maintenance in the amount of $1 billion was left on Class I railroads at the close of last year.

This was shown by the latest issue of the "Railroad Maintenance Study," which is made annually by the Engineering Section of the Interstate Commerce Commission's Bureau of Valuation. It represented a decrease of $50 million since the previous study, which put at $1,050 million the deferred maintenance as of December 31, 1951.

Like its predecessor, the present study found all the deferred maintenance in fixed-property items. It followed the general plan of previous studies, and carried the usual disclaimer to announce that it "has not been examined or passed on" by the commission.

The fixed-property items in which deferred maintenance was found, totaled $1,107,011,000, but the bureau deducted $122,400,000 to allow for "surplus maintenance" in equipment items—i.e., $120,000,000 in maintenance of locomotives other than steam, and $2,400,000 for superintend-

ence. The net figure was $984,611,000, and the bureau adopted the $1 billion as a round-figure estimate.

Explaining its failure to find any deferred maintenance of equipment, the bureau said that "deferred capital expenditures" should not be confused with deferred maintenance. It added: "While we appreciate that there is a shortage of freight-train cars, which results in cars being kept in service beyond the economic service life, the fact that patchwork repairs only are being made to such cars does not indicate deferred maintenance. This type of deferred maintenance will eventually be taken care of through retirement when traffic declines or when more new cars are available."

Further in regard to the equipment situation, the study had this to say: "At the close of the last war there were substantial amounts of deferred capital expenditures for equipment, but extensive purchases of new diesel-electric locomotives and new freight-train cars during the past few years have practically eliminated these deferred capital expenditures for equipment as a whole."

Armour Research Moving Headquarters

THE Armour Research Foundation of Illinois Institute of Technology, 35 West 33rd street, Chicago, plans to move its headquarters to the Arcade building at 10 West 35th street and the adjoining Binka bank building. The move is expected to be made by midsummer, Dr. Haldon A. Leedy, director, has announced.

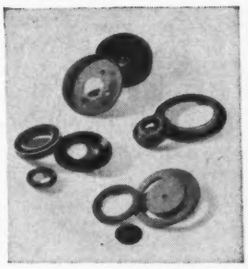
I. C. Refrigerator Car Insulation—A Correction

A DESCRIPTIVE article in the March, 1953, *Locomotives and Cars*, page 72, showed how well all major parts of the Illinois Central 40-ton experimental aluminum refrigerators car, No. 51,000 stood the test of six years service. This favorable performance extended also to the insulation which, however, was incorrectly designated as to type and should have been called Ultralite insulation, supplied in blanket form by the Gustin-Bacon Manufacturing Company, Kansas City, Mo., and made of glass fibers produced by this company.

1946 and 1952 Locomotive Services Compared

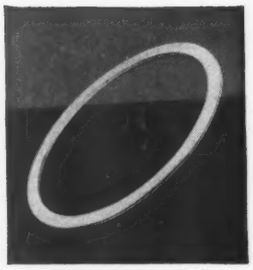
DIESEL-ELECTRIC locomotives handled 65.52 per cent of last year's road freight service 71.5 per cent of the passenger service, and 76.72 per cent of the yard service, the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission so reported in its latest "Monthly Comment." The road freight service was measured by gross ton-miles, excluding locomotives; the passenger service by passenger-train car-miles; and the yard service by yard miles; and the yard service by yard switching locomotive hours. The bureau's figures compared the 1952 situation with that of 1946.

The diesel-electric's 65.52-per-cent share of 1952 freight service compared with its 9.83-per-cent share in 1946. Meanwhile, the proportion handled by coal-burning

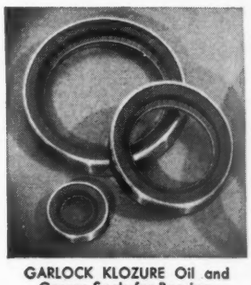


GARLOCK BITAN Leather Cups, Packings and Gaskets

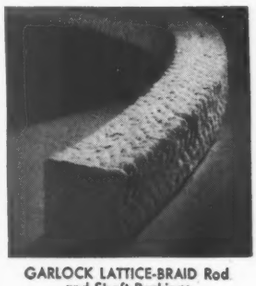
GARLOCK CHEVRON Hydraulic Packings



GARLOCK GUARDIAN Asbestos-metallic Gasket



GARLOCK KLOZURE Oil and Grease Seals for Bearings



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steam locomotives fell from 69.55 per cent in 1946 to 25.5 per cent last year; and the proportion handled by oil-burning steam locomotives dropped from 18.6 per cent to 7.1 per cent.

In passenger service, the diesel's 1952 share of 71.5 per cent compared with its 1946 share of 15.28 per cent. The 1946 proportions handled by coal-burning and oil-burning steam locomotives were 52.05 per cent and 26.19 per cent, respectively. In 1952, these were down, in turn, to 12.77 per cent and 9.11 per cent.

As compared with the more-than-three-fourths of the yard service, which they handled in 1952, diesel-electrics in 1946 handled 29.46 per cent of such service. Coal-burning steam locomotives performed 18.16 per cent of 1952 yard service, compared with 59.6 per cent in 1946, while the respective proportions performed by oil-burning steam locomotives were 3.86 per cent and 9.57 per cent.

The relative position of the electric locomotive changed little between 1946 and 1952. Its 1952 proportions of freight, passenger, and yard services, respectively, were 1.77 per cent, 6.62 per cent, and 1.21 per cent. Comparable 1946 figures were 2.11 per cent, 6.48 per cent, and 1.32 per cent.

The accompanying table, reproduced from the "Comment," shows for 38 large railroads (those with 1952 revenues above $50 million) the proportions of their freight, passenger and yard operations handled by diesel-electrics in 1952, compared with 1946.

PERCENTAGES OF FREIGHT, PASSENGER AND YARD SWITCHING OPERATIONS HANDLED BY DIESEL-ELECTRIC LOCOMOTIVES*—LARGE LINE-HAUL RAILWAYS, YEARS 1952 AND 1946

Road	Freight service[1]		Passenger service[2]		Yard switching service[3]	
	1952	1946	1952	1946	1952	1946
Eastern district and Pocahontas region						
Pennsylvania	59.6	0.1	51.0	0.5	73.0	2.7
New York Central	66.2	1.4	50.8	6.7	61.1	28.0
Baltimore & Ohio	58.7	6.0	64.5	41.9	64.5	18.4
Chesapeake & Ohio	52.8	....	90.5	2.2	80.6	5.3
Norfolk & Western	0.8	....	....	....	....	....
Erie	98.7	11.9	96.6	....	94.2	9.1
N. Y., C. & St. L.	2.4	....	97.1	....	77.9	12.0
N. Y., N. H. & H.	81.2	34.3	58.5	34.1	91.4	64.6
Reading	69.8	21.3	74.3	10.5	80.7	39.7
Wabash	98.4	....	96.8	6.7	91.1	36.3
Del., Lacka. & Western	98.7	24.8	85.5	0.2	83.7	50.0
Boston & Maine	98.4	70.8	86.2	21.5	88.2	49.9
Lehigh Valley	100.0	0.2	96.6	0.6	98.9	43.4
Delaware & Hudson	54.3	0.1	57.2	0.3	94.3	20.7
Grand Trunk Western	57.7	0.5	0.8	0.5	60.2	44.1
Southern region						
Illinois Central	2.6	....	73.0	13.1	67.4	21.4
Southern	98.2	12.7	95.8	25.8	88.2	27.9
Louisville & Nashville	61.0	....	93.7	42.4	84.5	23.9
Atlantic Coast Line	99.7	25.1	99.5	52.4	98.6	36.4
Seaboard Air Line	97.3	35.9	98.5	54.8	91.5	33.0
Gulf, Mobile & Ohio	100.0	25.5	100.0	64.9	100.0	57.3
Western district						
A. T. & S. F. and affiliated companies	72.7	34.4	89.4	19.2	88.6	48.2
Southern Pacific Co.	66.1	....	32.1	1.5	60.2	36.8
Union Pacific	32.9	0.1	56.8	11.1	77.3	44.0
Chic., B. & Q.	78.3	29.8	97.5	52.8	77.4	60.0
C., M., St. P. & P.	66.4	18.6	77.6	16.2	75.1	35.7
Great Northern	64.7	29.8	95.9	24.2	83.6	46.6
Missouri Pacific	79.3	11.0	84.0	10.5	75.7	23.7
Chicago & North Western	82.8	5.1	66.8	20.9	72.0	44.2
Chic., R. I. & Pacific	85.5	22.1	95.0	31.4	83.7	52.1
Northern Pacific	48.1	11.3	84.2	1.4	50.3	43.0
Texas & New Orleans	56.3	....	59.3	....	88.5	21.6
St. L.—S. F.	100.0	....	100.0	....	95.8	41.6
M-K-T Lines	99.3	0.2	99.6	....	89.7	4.0
Denver & R. G. W.	87.5	32.3	89.5	18.5	77.8	64.8
Texas & Pacific	99.7	....	100.0	....	99.9	0.8
St. L. S. W. Lines	93.0	36.2	62.4	....	92.6	68.3
Western Pacific	94.6	50.7	99.6	1.4	82.0	82.8

* Principal locomotive in train.
[1] Based on gross ton-miles of cars, contents and cabooses.
[2] Based on passenger train car-miles in locomotive propelled trains only.
[3] Based on yard switching locomotive hours in freight and passenger services.

British "Machine Tool Caravan"

A BRITISH "Machine Tool Caravan," valued at $100,000, set up in a car of the New York, New Haven & Hartford, was on press display at the Grand Central Terminal, New York, on Friday, April 10. The 14 tools in the Caravan are operating under actual machine-shop conditions and are attended by factory-trained service men. They were outfitted by the International Machinery Division of the British Industries Corporation, New York, and have no American counterparts. All are high-precision tools. Included are production lathes which meet tool-room requirements, a shaper which cuts and finishes punches to contour with one setting, a jig boring mill with optical measuring system accurate to within .00025 in., and several tool-room grinders and milling machines.

Following the press display at Grand Central, the Caravan left for appearances in New Haven, Boston, Providence, Syracuse, Buffalo, Cleveland, Detroit, Cincinnati, Pittsburgh, and other industrial centers. Attendance is by invitation.

Colchester 17-in. precision lathe—One of the machine tools in the British "Machine Tool Caravan."

Miscellaneous Publications

REFRIGERATOR CAR FINISHES. *Transportation Sales Division, Sherwin-Williams Company,* 101 Prospect avenue, Cleveland 1. Revised 16-page booklet, "Painting Specifications for Refrigerator Cars." Discusses the advantages of the "Flash-Dri" and "Fast-Dri" finishing systems, both standard and synthetic, for structural and concealed surfaces, exterior sides, ends, and roofs of metal or wood; trucks, and exterior woods and plywood. Contains also information on finish assembly and cleaning preparatory to painting new equipment, or for spot repair or refinishing previously painted equipment.

(*Turn to page 106*)

KEEPING THE IRON HORSE

FROM A *Nervous Breakdown*

Wires used inside Diesel locomotives are nothing less than their nervous systems. Undependable wires can result in the complete collapse of the function they service, sometimes at a critical point. You need a wire that can take the beating, the pounding, the vibration, heat and oil that play such a large part in shortening the life of these wires.

Simplex Diesel Locomotive Wires have an extra-strong constitution to withstand the above hazards. Insulated with Anhydrex and jacketed with a thin but tough wall of neoprene, they combine stable electrical properties with effective resistance to oils, grease, acids and flame. They do not have fibrous braids to fray or hold moisture.

The light weight, small diameter and flexibility of Simplex Diesel Locomotive Wires assure fast, easy installation. Their smooth-jacketed surface permits easy pulling through conduits without the use of lubricants.

For top quality, trouble-free service at low cost, specify Simplex Diesel Locomotive Wires. Complete information may be obtained from your nearest Simplex representative or by writing to the Railroad Department at the address below.

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

(*Continued from page 100*)

ELECTRICAL INSULATIONS. *Johns-Manville*, 22 East 40th street, New York 16. 32-page illustrated booklet, "Quinterra— Quinorge." Describes development, characteristics, and use of these purified asbestos insulations. Test methods fully explained and test data on physical and electrical properties tabulated for the designer of electrical equipment. Separate tables for each of the several types of Quinterra and Quinorge. Advice also given on application techniques and equipment, with step-by-step illustrations of methods now in use.

AUTOMATIC SLACK ADJUSTER. *Klasing Hand Brake Company*, 14 Henderson avenue, Joliet, Ill. Booklet consists of one page of descriptive data on the Klasing automatic slack adjuster, and four diagrams, one showing the design of the slack adjuster; the remaining three its application to box and gondola cars and a 95-ton ore car.

SUPPLY TRADE NOTES

BOWERS BATTERY & SPARK PLUG CO.— *James J. Law, Jr., R. E. Jaccard* and *James Peterman* have been added to the sales and engineering staff of the Bowers Battery & Spark Plug Co. Mr. Law's territory will be central and eastern Pennsylvania, excluding Philadelphia; Mr. Jaccard's, Philadelphia, southern New Jersey and south to Richmond, Va., and Mr. Peterman's, western Pennsylvania, eastern Ohio and West Virginia.

■

GENERAL MOTORS CORPORATION, ELECTRO-MOTIVE DIVISION.—*J. F. Kidwell*, service engineer of the Electro-Motive Division, has been appointed district engineer at Denver. *D. O. Brooks* has been appointed sales manager of the Division, while *W. R. Instone* has been named branch representa-

SELECTIVE MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of December 1952	Month of December 1951	11 months ended with December 1952	11 months ended with December 1951
3	Road locomotive miles (000 (M-211):				
3-05	Total, steam	15,070	21,004	203,755	295,548
3-06	Total, Diesel-electric	29,656	24,810	331,044	273,808
3-07	Total, electric	684	760	9,000	9,695
3-04	Total, locomotive-miles	45,459	46,574	544,221	579,073
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,578	1,586	19,807	20,594
4-06	Empty, total	1,281	1,247	10,808	10,601
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	25,222	36,248	357,779	519,059
6-02	Total in oil-burning steam locomotive trains	6,962	8,885	99,691	139,825
6-03	Total in Diesel-electric locomotive trains	79,782	66,202	919,208	762,331
6-04	Total in electric locomotive trains	1,827	2,023	24,859	26,451
6-06	Total in all trains	113,951	113,366	1,403,013	1,447,812
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.03	1.04	1.03	1.04
10-02	Loaded freight car-miles	37.80	37.70	39.80	39.50
10-03	Empty freight car-miles	23.30	20.90	21.80	20.30
10-04	Total freight car-miles (excluding caboose)	61.10	58.60	61.60	59.80
10-05	Gross ton-miles (excluding locomotive and tender)	2,729	2,693	2,822	2,773
10-06	Net ton-miles	1,216	1,251	1,296	1,300
12	Net ton-miles per loaded car-mile (M-211)	32.20	33.20	32.50	33.00
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	61.90	64.30	64.70	66.00
14	Averages per train hour (M-211):				
14-01	Train miles	18.10	17.10	17.60	17.00
14-02	Gross ton-miles (excluding locomotive and tender)	48,962	45,525	49,118	46,407
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	44.10	42.70	45.00	46.00
14-02	All	42.10	40.70	42.80	43.80
15	Average net ton-miles per freight car-day (M-240)	838	871	901	954
17	Per cent of home cars of total freight cars on the line (M-240)	47.00	40.80	43.50	37.50

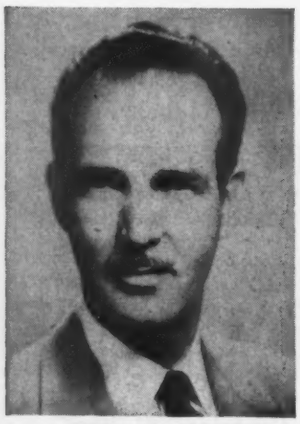
PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000).				
3-05	Steam	6,366	9,935	79,704	119,382
3-06	Diesel-electric	20,615	18,001	225,709	198,112
3-07	Electric	1,727	1,782	19,445	19,548
3-04	Total	26,708	29,718	324,865	337,043
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	296,152	295,305	3,259,361	3,293,157
4-09	Total in coal-burning steam locomotive trains	35,578	54,382	416,213	629,385
4-10	Total in oil-burning steam locomotive trains	23,722	33,005	296,902	388,031
4-11	Total in Diesel-electric locomotive trains	217,707	188,657	2,330,334	2,065,563
12	Total car-miles per train-miles	10.13	9.87	9.80	9.61

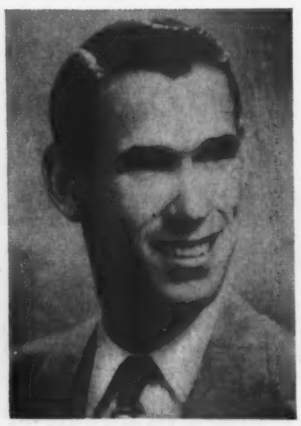
YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	688	1,025	9,482	14,177
1-02	Steam, oil-burning	138	192	1,958	2,796
1-03	Diesel-electric[1]	3,455	3,180	38,331	35,733
1-06	Total	4,306	4,420	50,052	53,010
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	26	44	324	540
2-02	Steam-oil-burning	8	13	123	156
2-03	Diesel-electric[1]	285	280	3,093	2,945
2-06	Total	355	373	3,940	4,045
3	Hours per yard locomotive-day:				
3-01	Steam	6.70	7.30	7.00	7.80
3-02	Diesel-electric	16.50	17.10	16.20	17.20
3-05	Serviceable	14.70	14.40	14.40	14.40
3-06	All locomotives (serviceable, unserviceable and stored)	13.00	12.50	12.50	12.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.88	1.92	1.75	1.78
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.74	0.78	0.75	0.76

[1]Excludes B and training A units.



D. O. Brooks



W. R. Instone

A. E. Gasparini

tive of the Jacksonville factory branch.

Mr. Brooks joined Electro-Motive as a stock clerk in 1939 and progressed to branch representative, which position he held before his present appointment.

Mr. Instone joined Electro-Motive in 1950 following six and one-half years in the U. S. Navy. He served as senior clerk prior to his present appointment.

R. G. Pommier

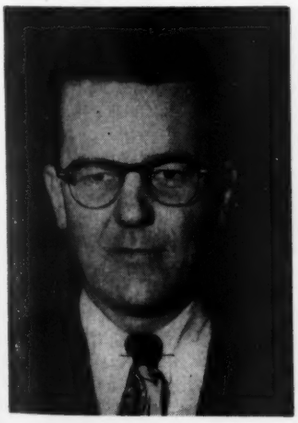
A. E. Gasparini and *R. G. Pommier* have been appointed district sales managers, St. Louis, as announced in the April issue.

Mr. Gasparini attended Northwestern University before joining Electro-Motive in April 1941 as secretary to chief engineer. From 1943 to 1946 he served with the U.S. Army in military railway service and military government in the European theatre. Upon his return to Electro-Motive he went into sales work, and most recently has served as sales representative in the St. Louis regional office.

Mr. Pommier joined E.-M.D. in 1942 as a service instructor. After World War II service in the Navy, he returned to Electro-Motive in 1947 and progressed to sales representative—the post he held prior to his appointment as district sales manager.

■

VAPOR HEATING CORPORATION.—*James T. Chinland*, mechanical inspector of the



J. T. Chinland

Chicago, Burlington & Quincy, has joined the Vapor Heating Corporation, Chicago, as service representative.

AMERICAN BRAKE SHOE COMPANY, BRAKE SHOE AND CASTING DIVISION.

The sales department of the Brake Shoe and Castings division has appointed *John F. Ducey, Jr.*, vice-president, at San Francisco; *George E. Anne* assistant vice-president at Philadelphia; and *Daniel J. Wagner* district sales manager Chicago.

Mr. Ducey joined the division as an apprentice in 1936. He was appointed sales inspector in 1937, sales representative in 1945, district sales manager in 1949, and assistant vice-president in 1951.

Mr. Anne has worked as sales representative since he joined the division in 1925.

Mr. Wagner joined the division in 1946 as a sales apprentice and in 1947 was appointed sales representative at New York.

NATIONAL BEARING DIVISION.—*S. R. Watkins* has been appointed executive vice-president of the National Bearing division, with headquarters at St. Louis.

Mr. Watkins joined the company in 1939 as a member of the sales department of the Brake Shoe & Castings division. In 1941 he entered the U.S. Army, where he served as captain of field artillery. Mr.

Tips on TESTING...

...ELECTRICAL INSULATION RESISTANCE

Reconditioning Wet Apparatus

The bad effects of excessive moisture in insulating material, particularly when localized, are numerous. The effect most likely to result in failure in the early stages of exposure is that of low resistance paths which may develop either through or over the surface of the insulation. The likelihood of failure from this cause is increased by the presence of dirt and other foreign matter, and may occur in either organic or inorganic insulating material.

If moisture has been deposited on clean insulation only superficially, then the heat resulting from the normal operating temperature of the equipment may remove it before failure occurs. However, the normal operating heat of at least some parts of the equipment is sometimes insufficient to drive out moisture that has penetrated through surface defects.

If moisture is allowed to remain in insulation, it usually—in time—causes corrosion of metal conducting parts, aggravated by the presence of chemicals and electric potential, thus increasing the danger of failure.

In addition to apparatus which may be exposed to moist atmosphere, or wet with fresh water, there may be occasions when it becomes necessary to rehabilitate equipment that has been subjected to salt water. In such case, clean fresh water must be used to remove all traces of salt before drying of the apparatus is attempted. Any evidence of oil or grease on the insulation should also be removed by using a volatile solvent such as carbon tetrachloride.

Then the apparatus must be dried out before electrical potential is applied. Numerous methods and various temperatures for drying out electrical equipment are used, including forced hot air, ovens, circulating electric current through the conductors, or combinations of these methods. Local conditions and facilities, manufacturer's recommendations, and the type of equipment involved, dictate the method used.

Test Procedure

If possible, secure records of previous insulation resistance tests on the apparatus.

Make short-time tests and time-resistance tests for comparison to help decide whether drying is necessary. If present readings are at all comparable with previous tests made at or corrected to the same temperature, a drying-out run *may* not be necessary.

NOTE: *The above material is taken from our Instruction Manual—for the use of Megger Insulation Testers. Within its 96 pages, such subjects as "Temperature Correction", "Interpretation" and many others are discussed in a clear and interesting manner with very ample illustrations, charts and tables. We'll be glad to send you a copy of this manual without obligation. Just write on your company letterhead for* ***Manual 21-J-X.***

JAMES G. BIDDLE CO.

ELECTRICAL TESTING INSTRUMENTS

•

SPEED MEASURING INSTRUMENTS

•

LABORATORY & SCIENTIFIC EQUIPMENT

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James G. Biddle Co. B-919-R
1316 Arch St., Phila. 7, Pa.
Gentlemen:
Please send me material checked:
☐ 21-J-X ☐ Check list of all Bulletins available

NAME

JOB FUNCTION

COMPANY

ADDRESS

Watkins rejoined Brake Shoes sales force in 1946 and, in 1949, was named district sales manager for the division. He was appointed assistant vice-president in 1951.

■

PENNSYLVANIA SALT MANUFACTURING COMPANY.—*Albert H. Clem*, formerly assistant general sales manager, has been appointed general sales manager of the Pennsylvania Salt Manufacturing Company, to succeed *Russell S. Roeller*, deceased.

■

PYLE-NATIONAL COMPANY.—*E. H. Reed* has been appointed assistant sales manager of Pyle-National, and *John Devol* district manager for the Chicago territory.

Mr. Reed joined the company in 1925 as a design engineer. He was transferred to the sales department in 1939; was appointed Chicago district manager—sales in 1949 and manager of the special products division in 1952. Mr. Devol joined the company in 1945 as assistant personnel director and transferred to the sales department in 1948.

■

UNION ASBESTOS & RUBBER CO.—*William G. Gray*, who will represent Union Asbestos & Rubber on special assignments as announced in the April issue, is a graduate of Pennsylvania State College (B.S. in Industrial Designing 1926). He served in the mechanical department of the Lehigh Valley for 11 years before joining the Union Pacific in 1937 as engineer of freight-car design. For two years, beginning in 1940, Mr. Gray worked with the Mechanical Division of the Association of American Railroads in Chicago,

William G. Gray

and from 1942 to 1944 was master mechanic of the Virginian. Prior to his association with Union Asbestos he was manager of railroad sales for the Pittsburgh Steel Company, Chicago, with which company he had been for nine years.

■

OLIVER IRON & STEEL CORP.—The corporation has opened a new general sales office in the Oliver Building, Pittsburgh 22.

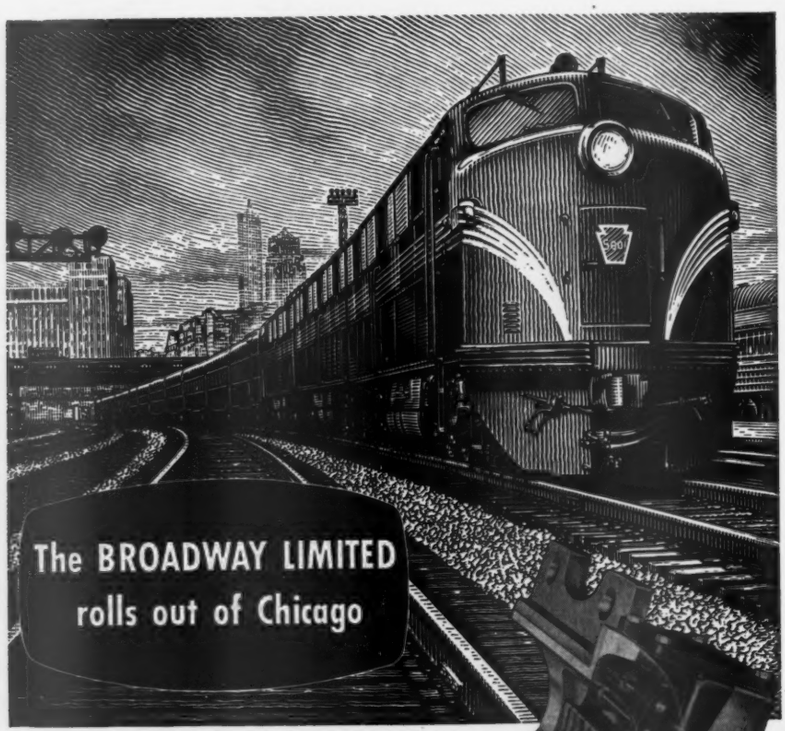
■

AMERICAN LOCOMOTIVE COMPANY.—*John P. DeLaney* has been appointed to the newly created position of general manager transportation services of the Alco. Mr. DeLaney will be in charge of sales of diesel locomotives and renewal parts, factory rebuilt service and locomotive field service,

John P. DeLaney

as well as sales of diesel engines and parts for marine, pipeline and other stationary installations. *Gordon P. Link*, manager of renewal parts, will continue in charge of distribution and sales of locomotive renewal parts and replacement parts for marine and stationary diesel engine customers.

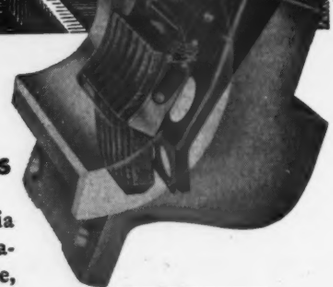
Mr. DeLaney is a graduate of Union College (1937). After graduation he joined the manufacturing department at Alco's Schdenectady plant. In 1941 he was trans-



Pennsylvania Railroad's Diesels depend on... FELPAX Lubricated Bearings

The suspension bearings on Pennsylvania Railroad's Diesels receive instant lubrication with the first revolution of the axle, continuous lubrication at all speeds. Waste grabs and starved bearings caused by old fashioned yarn packing are eliminated. Special wicks, exclusive with Felpax Lubricators, last thousands of miles . . . help maintain fast schedules.

Solve your suspension bearing lubrication problems with Felpax Lubricators. See your locomotive builder or write:



the lubricator that eliminates repacking

MILLER FELPAX CORPORATION
WINONA MINNESOTA

ferred to the service department at St. Louis, and in 1944 was assigned to the New York sales office. Two years later he was appointed manager of technical sales at Schenectady and in 1950 was appointed manager of Alco-GE sales and field service division.

■

UNITED STATES STEEL CORPORATION.—A site near Pittsburgh has been chosen by the United States Steel Corporation for a new research center, which will be devoted both to applied research and to coordination of projects currently under way in U.S.S. laboratories at plants throughout the country. Military requirements will be the basis for much of the immediate work to be undertaken although industry-wide problems—such as how to offset deteriorating quality of available raw materials—also well be studied. A design submitted for the center proposes three buildings with a combined floor area of approximately 132,000 sq. ft.—a main laboratory building, an experimental engineering shop, and an industrial process development building.

Lewis T. Gibbs, assistant to the manager of sales in the railroads materials division, has been appointed assistant manager of

Lewis T. Gibbs

sales in the corporation's high-strength-steel division.

Mr. Gibbs, a graduate of the University of Maryland with a B.S. degree in civil engineering, joined U. S. Steel in 1936 as a metallurgical observer at the Homestead District Works. He completed the Carnegie-Illinois sales training course in 1938 and was assigned to the company's Buffalo sales office. From there he was transferred to Hartford, Conn., and Baltimore. He returned to Pittsburgh in 1946 as a product representative in railroad sales.

■

GISHOLT MACHINE COMPANY.—*Werner I. Senger* has been appointed to the newly created position of vice-president in charge of balancing. Mr. Senger has been with Gisholt for over 35 years. He has been in charge of balancing-machine development and engineering since 1924.

■

WESTINGHOUSE AIR BRAKE COMPANY, AIR BRAKE DIVISION.—*H. R. Odell* has been appointed representative in the Southwestern district with headquarters in St. Louis. Mr. Odell had been service engineer in the same district since January 1949. *H. W. Wiss* has been appointed representative in the Western district with head-

What is your cost of diesel traction motor commutator reconditioning? In labor? In time out for service?

This cost, of course, varies greatly on different railroads. But it can be greatly minimized by the proper choice of a traction brush grade.

Stackpole Carbon Company diesel traction brush engineering is aimed first of all at good commutation and stable filming qualities under the most adverse conditions. Records of many users prove the ability of Stackpole brushes to keep commutators in service for exceptionally long periods. *In some particularly difficult types of service, Stackpole brushes have actually improved poor commutator conditions that developed when other makes of brushes were used.* The records show that this has been accomplished with entirely adequate brush life.

STACKPOLE
diesel-electric
BRUSHES

BRUSHES FOR ALL ROTATING ELECTRICAL EQUIPMENT • BEARING MATERIALS BRAZING FURNACE BOATS • CARBON PILES • CLUTCH RINGS • CONTINUOUS CASTING DIES • DASH POT PLUNGERS • FRICTION SEGMENTS RAIL BONDING MOLDS • RESISTANCE WELDING AND BRAZING TIPS • SEAL RINGS • TROLLEY AND PANTOGRAPH SHOES... and dozens of carbon-graphite specialties

STACKPOLE CARBON COMPANY, *St. Marys, Pa.*

All Metal THERMOMETERS

with WESTON dependability built-in

The heart of the modern, dial-type thermometer is the all-metal temperature element. Developed over 15 years ago, the WESTON all-metal element has plenty of proof behind it. In fact, the dependable accuracy of this unit has made the readable WESTON thermometer favorite for laboratory use as well as for all industrial temperature needs. For *extra* dependability, specify WESTON all-metal thermometers . . . available in the types, ranges and sizes indicated below. Literature available. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.

Type	Scale Length	Ranges		Stem Length		% Accuracy of Thermo. Range
		As low as	As high as	As short as	As long as	
Heavy Duty Straight Form	9"	−100F	+1000F	2½"	48"	1
Heavy Duty Angle Form	9 or 12"	−100F	+1000F	2½"	72"	1
Standard Angle Form	6"	−100F	+1000F	2½"	72"	1
General Purpose	4½"	−100F	+1000F	2½"	36"	1
Laboratory	3.40"	−100F	+500F	2"	24"	½ of 1

WESTON *Instruments*

799

quarters at Denver. Mr. Wiss since May 1947 had been service engineer at New York. *C. J. Werlich*, manager of the company's Southwestern district at St. Louis since July 1942, has retired. Mr. Werlich joined Westinghouse Air Brake Company in October 1920. His railroad training was on the Chicago, St. Paul, Minneapolis & Omaha as fireman, locomotive engineer and traveling fireman.

■

BRANDON EQUIPMENT COMPANY.—*D. I. Packard* has joined the Brandon Equipment Company, Chicago, as vice-president in charge of sales.

D. I. Packard

■

FAIRBANKS, MORSE & CO.—*J. W. Elwin*, Chicago, sales representative, has been appointed district manager, locomotive sales, for the Chicago area including the Twin Cities and St. Louis. Mr. Elwin joined the Fairbanks-Morse Diesel Locomotive Sales Division about a year ago.

J. W. Elwin

■

MAGNAFLUX CORPORATION.—The Magnaflux Corporation, Chicago, has moved to a new and larger plant at 7300 West Lawrence Avenue. All manufacturing and engineering activities, as well as the company's general offices, have been removed from the old plant.

■

JOSEPH T. RYERSON & SON, INC.—Joseph T. Ryerson & Son, Inc., has begun construction of a new steel service plant in Milwaukee. Site of the new building, which

will replace the present plant at 320 South 19th street, is at South 84th street and the Chicago, Milwaukee, St. Paul & Pacific railroad. The plant will consist of two large building units and an office building and will have approximately 166,000 sq. ft. of floor space, about three times present plant capacity.

■

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY.—*C. P. McDonald* has been appointed sales engineer for the transportation division of the Minneapolis-Honeywell Regulator Company. With headquarters in

C. P. McDonald

Washington, D. C., Mr. McDonald will cover the southeastern part of the United States, handling sales and servicing of controls for railways, buses, streetcars and other transportation vehicles. The area formerly was covered out of the company's Philadelphia office.

■

LORD MANUFACTURING COMPANY.—*Walter M. Waldbauer* has been appointed field engineer for the Lord Manufacturing Company. Mr. Waldbauer will cover the north-

W. M. Waldbauer

western Ohio section, with headquarters at 811 Hanna building, Cleveland. He formerly was a project engineer at the company factory.

■

AIR REDUCTION SALES COMPANY.—*A. C. Brown, Jr.*, formerly regional manager at Pittsburgh for the Air Reduction Sales Company, has been appointed general sales manager, with headquarters at 60 East 42nd street, New York. *J. H. Keeney*, formerly administrative assistant in Pittsburgh, succeeds Mr. Brown as regional manager; *J. H. Hart*, Detroit district manager, succeeds Mr. Keeney, and *R. A. Jamieson*, assistant sales manager, Detroit, succeeds Mr. Hart.

■

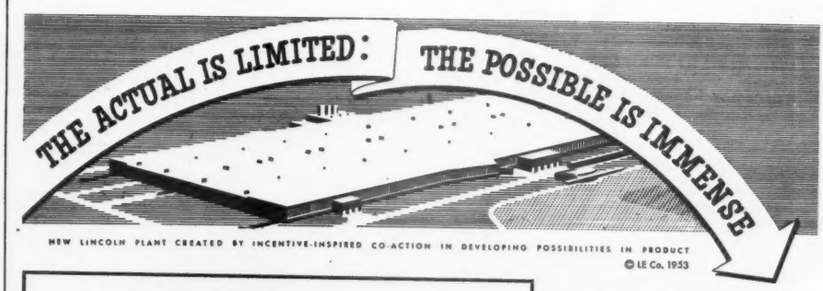
GRAYBAR ELECTRIC COMPANY.—*J. W. Riddell* has been appointed manager of the Reading, Pa., branch of Graybar to succeed *T. J. Hopkins*, deceased. *H. E. Orr* has been appointed operating manager of the Amarillo, Tex., branch.

REYNOLDS METALS COMPANY, PAINT MARKET DIVISION.—*Douglas McKellar* has been named manager, paint market sales, and *Edward F. Reilly* assistant manager of the paint sales division.

Mr. McKellar is a graduate of Yale University with a Bachelor of Science degree. Prior to his association with Reynolds Metals, he was employed in chemical pigment sales by the Kentucky Color & Chemical Co., Louisville.

Mr. Reilly joined Reynolds in 1940 and has been actively engaged in paint market sales work for several years.

(*Turn to page 114*)


THE ACTUAL IS LIMITED: THE POSSIBLE IS IMMENSE
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT
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"TWINARC'S" FASTER, LOWER COST WELDING BOOSTS SHOP EFFICIENCY

It is now possible to realize savings up to 35% in the cost of automatic welding with Lincoln's new "TWINARC". Welds have deeper penetration, greater uniformity . . . and are produced at *speeds 50% higher* than possible with single electrode automatic welding.

Reports from code welding fabricators indicate quality superior to conventional automatic processes.

With "TWINARC", welding currents up to 1200 amps are concentrated on two small diameter electrodes (Fig. 1). These electrodes can be set in line with the work for tandem welding to attain maximum penetration at high speed. For welding thin material or assemblies with fitup the "TWINARC" head may be rotated in any position to 90 degrees across the joint to spread the arc, reducing the danger of burning through.

"TWINARC" welding is only one of many new Lincoln developments designed to cut your costs. Have your Lincoln representative survey your needs and recommend latest techniques to speed welding, to simplify your operations and save money.

Fig. 2. Automatic Lincolnweld LAF-2 with new "TWINARC" attachment. "TWINARC" replaces original single electrode jaws. Operates with same single controls. Inset shows butt weld in 1½" plate with single pass on each side with "TWINARC". Welding speed is 38% faster than possible with single electrode.

INCREASES WELDING SPEEDS 50% AND HIGHER TO CUT YOUR COSTS

Fig. 1. New Lincoln "TWINARC" . . . feeds two continuous electrodes simultaneously for faster, more efficient "hidden arc" welding in granular flux. Results . . . utilizes currents up to 1200 amps, produces deeper penetration, higher quality welds, at lower cost.

HANDLES A WIDER RANGE OF WORK

ANOTHER LINCOLN FIRST

GET THE FACTS *Bulletin on "TWINARC" welding giving latest speeds and procedures is available by writing on your letterhead to The Lincoln Electric Railway Sales Co., 11 Public Square, Cleveland 13, Ohio. Railroad representatives of*

THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO
The World's Largest Manufacturer of Arc Welding Equipment

It's a lot easier to work with RIDGID

Extra-Utility Pipe Vises

Compare those work-saver RIDGID Vises with any others and you see the bonus of extra utility you get for your money. Kit vise is easily toted to the job, quickly clamped on edge of bench or plank, ready for use. All other RIDGID vises have handy integral pipe benders and rests to make cutting and threading easier. Full-width firm-gripping jaws of top quality tool-steel, bodies of rugged special malleable—for years of service. 9 models, yoke and chain, 23 sizes, meet every need. Get your money's worth—buy RIDGID Vises at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

Magnus Safety Valve for Diesel Locomotive Steam Generators

- GREATER ACCURACY
- LONGER LIFE
- NO STEAM LEAKAGE

Magnus
Fig. 391
Safety Valve

Escape of steam into the engine cab is completely eliminated with the Magnus Fig. 391 Safety Valve. Added new features assure greater accuracy, positive safety and low-cost service.

Designed primarily for use on diesel locomotive steam generators, it is easily adjusted, has top and bottom guided feather valve, special spring and valve alloys. It is adjustable for either 245 or 300 pound boilers.

For further information write . . .

• MAGNUS BRASS MFG. CO.
Subsidiary of National Lead Co.
525 READING ROAD, CINCINNATI 2, OHIO

M & J Diesel Locomotive Filter Corporation.—*L. F. Duffy* has been elected president of the M & J Corporation, succeeding *Jack P. Morris* who has resigned. Mr. Duffy will continue also as chairman of the board. *Robert J. Drewniak* has been elected vice-president, succeeding *R. W. McNeily*, who also has resigned.

■

Westinghouse Electric Corporation.—*David C. Fulton*, formerly district machinery electrification manager of Westinghouse, has been appointed manager of marine, aviation and transportation sales, to succeed *Harold G. Rethmeyer*, who has been appointed manager of the company's newly established San Francisco branch office. *M. Wayne Scolari*, *George Skipton*, *G. Burnett Mason* and *David F. Roach* have been appointed sales supervisors at San Francisco.

■

Chase Brass & Copper Co.—*Payne C. Barzler, Jr.*, who has been southern Texas sales representative of Chase Brass, subsidiary of Kennecott Copper Corporation, has been named district manager of the newly-created Chase sales district in Houston, Tex., where a sales office and branch warehouse has been opened at 16 Drennan street.

■

American Brake Shoe Company.—*N. George Belury* has been elected a vice-president of the American Brake Shoe Company.

Mr. Belury, who will continue as president of the engineered castings division, has been with the company since graduating from Purdue University in 1937. He worked in the sales department of the Brake Shoe and Castings Division before transferring to engineered castings sales in 1947.

■

Texas Company.—*J. C. Droke* has been appointed assistant to manager, railway sales department, of the Texas Company, with headquarters in New York, and *W. S. Custis* has been appointed manager, St. Louis division, railway sales department.

Mr. Droke joined Texaco in 1940 as a lubrication engineer at Kansas City; spent several years with the foreign operations department in South America, and was in charge of the St. Louis division office at the time of his recent appointment.

Mr. Custis joined Texaco at Springfield, Mo., in 1943, as lubrication engineer, and was assistant division manager at Chicago prior to his appointment as assistant to manager at New York.

■

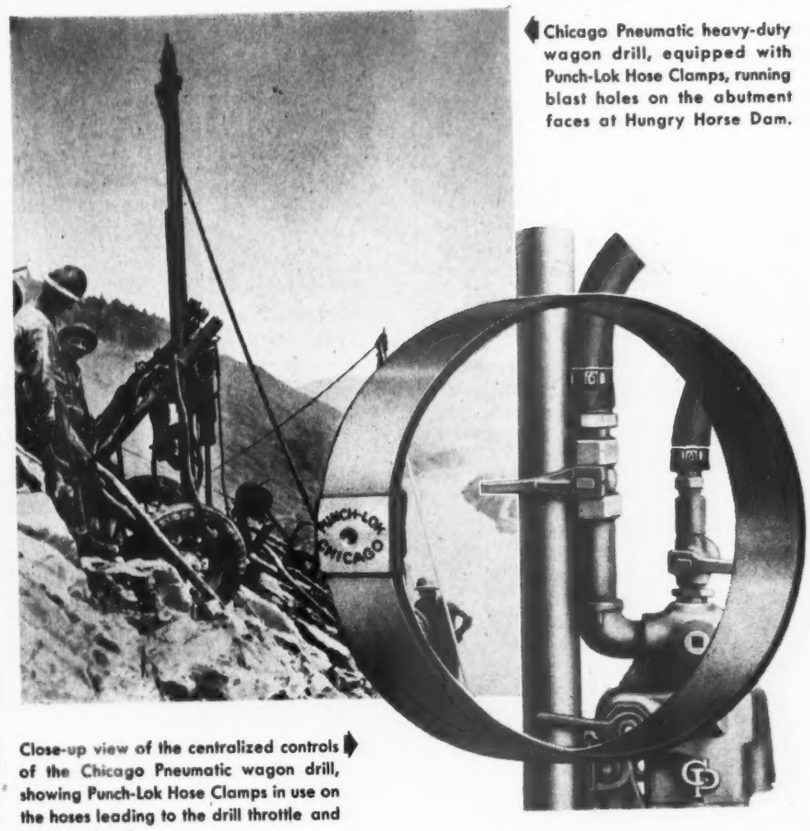
General Electric Company.—*Hugh Black* has been appointed wire and cable specialist for the construction materials division of G.E., with headquarters at 5726 West 51st street, Chicago. Mr. Black will handle contacts with railroads in the divisions' north central district.

■

A.M. Byers Company.—*Buckley M. Byers*, formerly assistant manager of steel sales of Byers, has been appointed general manager of wrought-iron sales.

The Perfect ANSWER FOR
ON-THE-JOB HOSE MAINTENANCE

PUNCH-LOK
HOSE CLAMPS



Chicago Pneumatic heavy-duty wagon drill, equipped with Punch-Lok Hose Clamps, running blast holes on the abutment faces at Hungry Horse Dam.

Close-up view of the centralized controls of the Chicago Pneumatic wagon drill, showing Punch-Lok Hose Clamps in use on the hoses leading to the drill throttle and blowing throttle.

With Punch-Lok Hose Clamps on the job . . . you're sure of having truly dependable hose connections. Maintenance costs are reduced because of Punch-Lok's trouble-free performance. When hose repairs are needed . . . Punch-Lok again saves you time and money. You'll be amazed to see how quickly and easily Punch-Lok Hose Clamps are applied.

"The Sign of a Good Hose Clamp"

4168

PUNCH-LOK Company

321 North Justine Street, Chicago 7, Illinois

GENERAL ELECTRIC COMPANY.—*Marvin J. Kolhoff* has been appointed manager of the locomotive and car equipment department laboratory of the General Electric Company at the Erie, Pa., works.

■

BAKER-RAULANG COMPANY.—*Merritt S. Stevenson* has been appointed manager of transportation sales for the Baker-Raulang Company. He will direct the company's sales activities in the rail, air and highway transportation fields and will work with shippers in development of efficient freight and baggage handling techniques. Mr. Stevenson formerly was national railroad representative for the Clark Equipment Company.

■

SNAP-TITE, INC.—*Armand A. Probeck* has been elected vice-president of Snap-Tite.

■

McDOUGALL-BUTLER CO.—*D. V. Maher & Co.*, 900 Marshall Bldg., Cleveland, has been appointed sales representative of McDougall-Butler for a number of roads and equipment builders throughout the east and midwest.

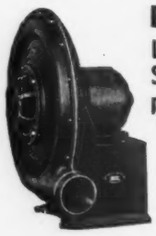
Obituaries

ROBERT H. GARDNER, 58, general sales manager of the A. M. Byers Company, died recently in the Allegheny General Hospital, Pittsburgh, after a brief illness.

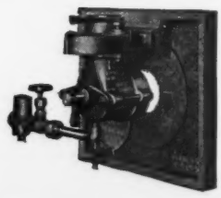
for long efficient service... SPECIFY JOHNSTON

RIVET FORGES
Economical Vacuum Oil Burner; no oil valve to clog. Approved and listed as standard by U.L.

BLOWERS
Low Pressure, Direct Connected. Simple, efficient, compact, dependable.



BURNERS
Oil and Gas. "Reverse Blast". Mixes ALL the fuel with ALL the air.



FURNACES
Forging, Flue Welding, Spring, Plate and Car Type. Also Fire Lighters, Tire Heaters, Etc.

THE JOHNSTON LINE OF DEPENDABILITY — SAFETY
JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.
ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

IDEAL — WIEDEKE · DAYTON · TUBE EXPANDERS

No. 40 Ideal

Ace Tube Expander

a leader in the field for more than 50 years!

preferred for portable and stationary fire tube boilers

Loose guard straddles flared or beaded tube ends. Bronze bearing reduces friction to a minimum, increasing life of tool. Insist on WIEDEKE Nationally Known Ideal Tube Expanders.

See Your Dealer, or Write Us Today!

THE GUSTAV WIEDEKE COMPANY
DAYTON 1, OHIO

RICHARD K. LEBLOND, founder and chairman of the board of the R. K. LeBlond Machine Tool Company, died at his home in Cincinnati on March 17, at the age of 88.

PERSONAL MENTION

Atchison, Topeka & Santa Fe

JOHN V. DOBBS, assistant car-lighting and air-conditioning engineer at Topeka, Kan., appointed car-lighting and air-conditioning engineer.

A. E. VOIGHT, car-lighting and air-conditioning engineer at Topeka, Kan., retired on December 31.

Bessemer & Lake Erie

SHERMAN O. RENTSCHLER appointed superintendent motive power at Greenville, Pa.

Born: Verdon, Neb., October 12, 1904.

Education: Graduate University of Nebraska.

Career: Became a special apprentice on the Missouri Pacific in September 1923. Later served as machinist, division foreman, and enginehouse foreman at various points,

and general shop foreman at Sedalia, Mo. Appointed shop superintendent in August 1942; mechanical superintendent, Southern district, with headquarters at St. Louis in October 1943; assistant chief mechanical officer in November 1944. Named superintendent motive power, Elgin, Joliet &

S. O. Rentschler

Eastern on April 1, 1945; general manager on December 1, 1946, and vice-president (operations) at Chicago on November 26, 1947.

Associations: Member Western Railway Club and Locomotive Maintenance Officers' Association (president (1947).

Boston & Maine

CLARENCE W. MCELROY, general foreman at Mechanicville, N. Y., diesel terminal appointed master mechanic, New Hampshire division, with headquarters at Concord, N. H.

EARL C. CONE, master mechanic, New Hampshire division, at Concord, N. H., appointed assistant superintendent of the Billerica (Mass.) shops.

PHILLIP G. BUKER, diesel inspector at Mechanicville, N. Y., appointed mechanical inspector, Fitchburg division, with headquarters at Greenfield, Mass.

WALWORTH B. WILLIAMS, mechanical inspector at Greenville, Mass., appointed assistant general foreman at Mechanicville, N. Y.

WALTER E. TRUE, assistant general foreman at Mechanicville, N. Y., appointed general foreman at Mechanicville.

Canadian Pacific

JAMES S. BAUER, district electrician at St. John, N. B., appointed supervisor of electrical equipment, Eastern Region, with headquarters at Toronto, Ont.

W. A. VANDERLAND, combustion engineer, appointed supervisor of stationary boilers, Prairie and Pacific region.

JOHN HAMILTON, supervisor of stationary boilers, Prairie and Pacific regions, has retired.

CHARLES W. GRIFFITH, road and terminal electrican, appointed district electrician at St. John, N. B.

LORD MOUNTINGS PROTECT INSTRUMENTS *and* ELECTRONIC EQUIPMENT *from* VIBRATION *and* SHOCK DAMAGE • • •

VIBRATION and shock are natural enemies of electronic equipment and precision instruments . . . To control the damage which these enemies can do, Lord Vibration Control Mountings and Bonded Rubber Parts are used to very profitable advantage. More than a quarter century's experience in dealing with vibration and shock is yours when you take advantage of Lord engineering assistance. The result of such consultation is full protection for electronic units and sensitive instruments by correctly designed and precisely manufactured Lord Mountings and Bonded-Rubber parts.

See Our Exhibit Booth No. 13N
Atlantic City June 22-27

BURBANK, CALIFORNIA 233 South Third Street
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PHILADELPHIA 7, PENNSYLVANIA 725 Widener Building
DAYTON 2, OHIO 410 West First Street
DETROIT 2, MICHIGAN 7310 Woodward Ave.
NEW YORK 16, NEW YORK 280 Madison Avenue
CHICAGO 11, ILLINOIS 520 N. Michigan Ave.
CLEVELAND 15, OHIO Room 811, Hanna Bldg.

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER — *Headquarters for* VIBRATION CONTROL

IDEAL

SHORTCUTS to better commutator maintenance

QUALITY-BUILT TO DO THE JOB RIGHT! . . .

The easiest way to restore commutators in traction motors and generators without dismantling during interim maintenance...or during periodic overhauls. IDEAL Resurfacers and other tools are used by leading railroads and recommended by locomotive builders.

RESURFACERS

Refinish commutators to like new condition even when ridged, scored or burned. Wood block handles clamp rigidly into grinder. Seven sizes, in all grades from extra coarse to extra polish.

MICA UNDERCUTTERS

Work easily in close quarters. Several models. Direct drive or by flexible shaft. For use with IDEAL Commutator Saws and Milling Cutters.

FLEXIBLE ABRASIVE

Cleans and burnishes commutators. Non-dusting. Complete size range.

CLEANER-BLOWERS

Blows air at high velocity and harmless low pressure. Lightweight and rugged. May also be used as a vacuum cleaner or sprayer. Three models: ⅖, ⅔ and 1⅓ H.P.

FREE 39-page Handbook
Complete information on commutator maintenance.
Mail coupon.

IDEAL Products Are Sold through Leading Distributors

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1563 Park Avenue, Sycamore, Illinois

Send FREE Handbook and catalog sheets on:

☐ Resurfacers ☐ Undercutters ☐ Flexible Abrasive ☐ Cleaner-Blowers

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Chesapeake & Ohio

C. R. BLAND appointed assistant electrical engineer—rolling stock, with headquarters at Richmond, Va.

H. A. WITTEN appointed assistant electrical engineer—fixed properties, with headquarters at Richmond, Va.

Chicago, Burlington & Quincy

W. A. NEWMAN, shop superintendent at West Burlington, Iowa, retired on April 30.

W. A. Newman

Born: April 17, 1883, at Mattoon, Ill.
Career: Served apprenticeship on Cleveland, Cincinnati, Chicago & St. Louis from 1901 to 1905. Served as a machinist on several roads for a number of years, returning to the Big Four in 1912 as air-brake supervisor. Became air-brake instructor on International Great Northern in 1915; general foreman of the Fort Worth & Denver City at Childress, Tex., in November 1918, and later master mechanic at Wichita Falls, Tex. Returned to Childress in 1920 as general foreman. Appointed general foreman of the Burlington shops at Denver in October 1939; assistant shop superintendent in March 1941, and shop superintendent on September 1, 1941.

Denver & Rio Grande Western

ROBERT L. JACOBSEN, a special apprentice at Burnham Shops, Denver, appointed mechanical engineer at Denver.

Erie

WALTER G. COLEMAN, appointed road foreman of engines, Kent division, with headquarters in Kent, Ohio.

New York Central

S. D. OLIVER, foreman electrician at Elkhart, Ind., has retired.

F. C. DOUBLE appointed foreman electrician at Elkhart, Ind.

Michigan Central

E. H. WRIGHT, assistant master mechanic at Detroit, transferred to Jackson, Mich.

Group of RUEMELIN Fume Collectors Keeps Shop Clear of Welding Fumes

This well ventilated welding department is typical of hundreds of similar installations. Welding operators appreciate smoke and gas-free atmosphere. Thousands in service. Many repeat orders. Collecting fumes AT THE SOURCE with local exhaust hoods has proven most practical in operation. It is particularly helpful in winter months when doors and windows are closed. Write for Bulletin 37-D describing all types of Ruemelin Welding Fume Collectors.

RUEMELIN MFG. CO.
MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT
3982 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

Norfolk & Western

HARRY C. WYATT appointed vice-president and general manager at Roanoke, Va., as announced in the March issue.

Born: Wyeth county, Va., June 16, 1902.

Education: Graduate Virginia Polytechnic Institute June 1924.

Career: Joined the N&W in 1916 as a mail carrier during school vacations. Subsequently served as clerk, helper car repairer, and car repairer during later vacations. After graduation from V. P. I.; became a special apprentice in Roanoke shops of N&W, later becoming shop inspector in shops at Roanoke; Bluefield, W. Va.; and Portsmouth, Ohio. Then served

Harry C. Wyatt

successively as assistant foreman and foreman at Iaeger, W. Va.; assistant road foreman of engineers on the Pocahontas division; general foreman at Columbus; and assistant master mechanic on the Radford and Shenandoah divisions. Appointed superintendent of the Shenandoah division in June 1939, transferring to the Scioto division in December 1940 and to the Pocahontas division in January 1942. Named assistant general superintendent of motive power at Roanoke in February 1942, which position he held at the time he was appointed vice-president and general manager.

RUSSELL G. HENLEY, general superintendent motive power at Roanoke, Va., retired on March 31.

Born: Walkerton, Va., May 17, 1884.

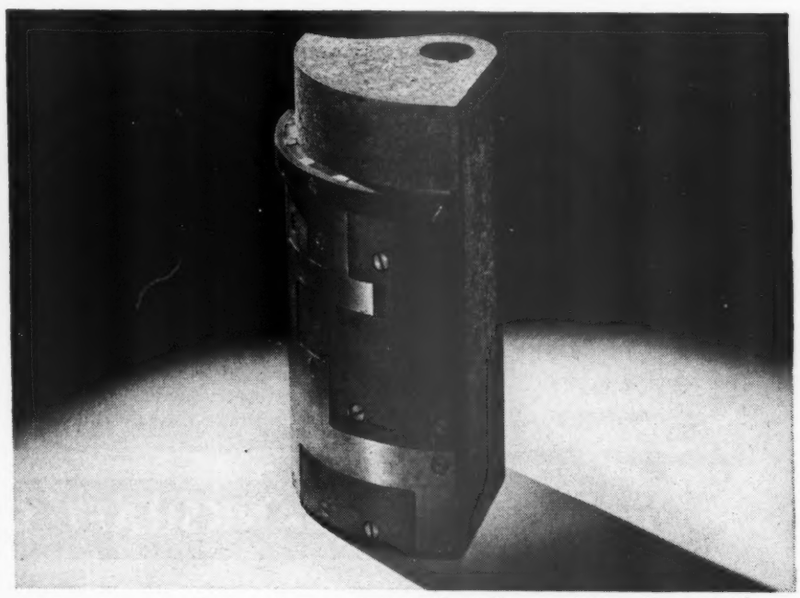
R. G. Henley

Education: Virginia Mechanics Institute (1901-02).

Career: Special apprentice with Richmond Locomotive Company 1900-05. Became a machinist on N&W at Bluefield, W. Va., in 1905; assistant enginehouse foreman at Bluefield in 1908; night enginehouse foreman at Williamson, W. Va., in 1911; enginehouse foreman at Bluefield in 1912; foreman at East Radford, Va., in 1915; general foreman at Kenova, W. Va., in 1916; master mechanic, Pocahontas and Scioto divisions, successively, in 1918. Appointed assistant to superintendent motive power at Roanoke in 1924; superintendent motive power in 1928, and general superintendent motive power in 1941.

Associations: Fellow, A.S.M.E. Member of General Committee, Mechanical Division, A.A.R., 1924-45, and chairman of the Division 1944-45. Chairman of Committee on Safety Appliances since 1934, and chairman of Committee on Geared Hand Brakes 1942-46.

C. E. POND, superintendent motive power, appointed general superintendent motive power, with headquarters at Roanoke, Va. Sketch and photograph of Mr. Pond appeared on page 133 of the April issue following his appointment as superintendent motive power.



A controller contact drum assembly, constructed of Celoron, Vulcanized Fibre and Brass.

A DRUM HARD TO BEAT!

Constructed of Celoron, Vulcanized Fibre and brass, this controller contact drum assembly controls a Diesel locomotive's speeds from stand-still to full speed. The two special C-D-F materials used — Celoron and Vulcanized Fibre — were chosen because of their unusual insulating and mechanical properties.

The drum body is molded C-D-F Celoron, a macerated canvas-filled phenolic material of superior electrical and mechanical strengths. C-D-F Vulcanized Fibre, a hard, dense, bone-like material . . . is between the contacts and enables the contact fingers to slide freely from metal to insulated surface. Fibre was specified because of its unusual arc extinguishing and non-tracking characteristics. Whenever a circuit is broken, the resulting arc is drawn out across the surface of one of the Vulcanized Fibre segments, thereby protecting the surface of the phenolic drum from the arc.

Whenever you need superior insulating materials, call your C-D-F sales engineer. C-D-F branches are located in principal cities.

DIAMOND VULCANIZED TRACK FIBRE	for rail joint insulation.
CELORON	molded and machined high strength plastics.
MICABOND	— bonded mica in tapes, sheets and special forms.
TEFLON	tapes and sheets of a new high strength plastic resistant to high heat and moisture.

THE NAME TO REMEMBER. . . DIAMOND VULCANIZED FIBRE AND CELORON

CDF

Continental-Diamond Fibre Company

NEWARK 104, DELAWARE

PERSONAL MENTION—*Obituary*

G. F. PATTEN, assistant superintendent of the car department of the Baltimore & Ohio at Baltimore, died on April 7 following a short illness.

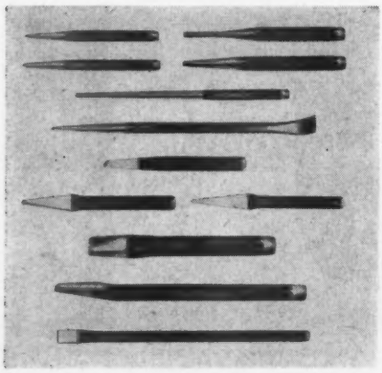
New Devices

(*Continued from page 95*)

a seat angle that eliminates warning whisper when valve opens. The base of the valve has been constructed to simplify dismantling and regrinding of the feather valve.

This device, made available by Magnus Brass Mfg. Co., Cincinnati 2, Ohio, is adjustable to operate on 245 and 300 lb. boilers. It is also suitable for greater capacity boilers since it is rated at 4238 lb. per hr. relieving capacity at 300 lb. per sq. in. steam pressure.

■



Punches and Chisels

With the addition of cape chisels, diamond point chisels, round nose chisels, extra long cold chisels and pinch bars, the J. H. Williams & Co., Buffalo 7, N. Y., has expanded their line of punches and chisels.

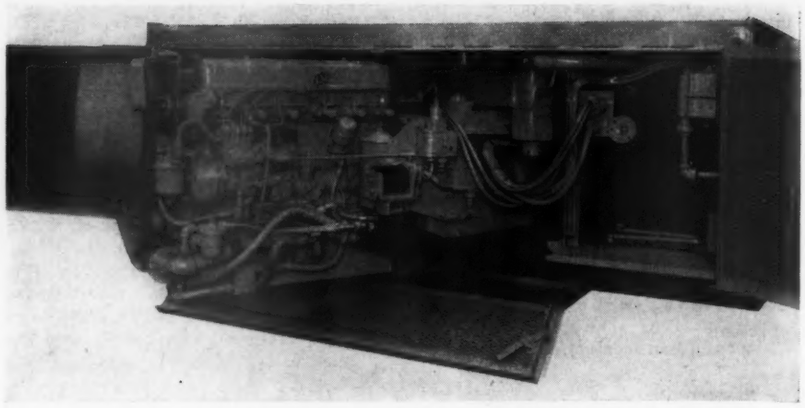
These tools are forged from octagon alloy steel. They have been hardened and tempered to stand up under severe service conditions.

■

Undercar Power Plants For Ambulance Cars

The U. S. Army is testing a new type of ambulance railroad car which will be used to transport wounded soldiers from port hospitals to hospitals nearest their homes. Capable of sustained and independent operation, the car is being built by a midwest car manufacturer with electrical equipment supplied by the General Electric Company.

The independent operation, which is the outstanding feature of this new car, is made possible by two G.E. diesel-electric undercar power plants.



The unit may be swung out from its housing under the car to facilitate cleaning and repair

Rated at 30 kw. each, the two power plants generate electricity for cooking, refrigeration, air-conditioning and heating. These loads require approximately 50 kw. per car.

A 50-hp. diesel engine is the prime mover of each unit. It drives a G.E. 220-volt alternating current 60-cycle alternator which, in turn, generates the electric power for the car.

Each car has an automatic load control system to start and stop the power plants according to load level whether the car is operated as a single car or in a series of cars utilizing the permanent trainline connections. Rubber mounting of the engine-alternator set reduces vibrations in the car.

Feeler Gages

Expanding their line, an assortment of 27 sizes of feeler gauge blades, 10 feeler gage sets and a dispenser have been eliminated by J. H. Williams & Co., Buffalo 7, N. Y.

Made of tempered Swedish steel, each blade is electro-etched with its decimal size and treated with rust resistant oil. Individual blades from 0.0015 to 0.04 in. are packed six to an envelope and are available in 3½ and 12 in. sizes or lengths.

The gauges are also made in a voriety of sets containing combinations of blade sizes. Sets have knurled lock nuts which allow the user to select required blade size and then lock it into position.

CRANKSHAFT GRINDING SERVICE

Established 1924 . . . 28 years experience grinding crankshafts! The most complete engine rebuilding shop in the Southwest!

THE LARGEST CRANKSHAFT GRINDING MACHINE IN THE WORLD USED IN AN INDEPENDENT REPAIR SHOP

★ HARD CHROMIUM PLATING SERVICE
★ CRANKSHAFT STRAIGHTENING SERVICE
★ MAGNAFLUX SERVICE

Four machines giving range from the smallest up to crankshafts with stroke of 16" and 200" O.A.L. Complete grinding service for locomotive, stationary, marine, automotive and compressor crankshafts. Undersized journals restored to size by hard chromium plating.

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